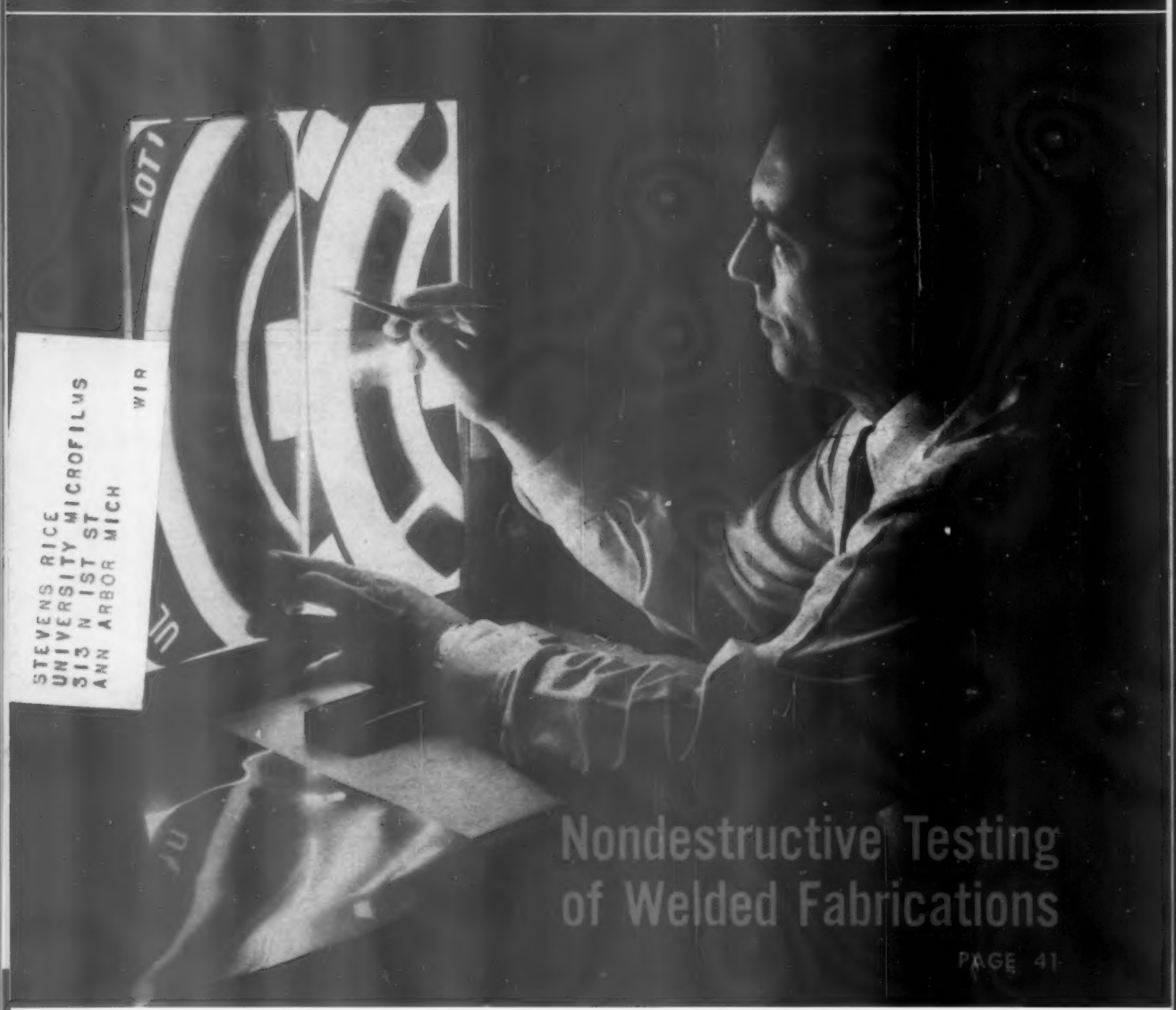
Industry & MARCH 1959

WELDING

WELDING MANAGEMENT · PRODUCTION · ENGINEERING



Nondestructive Testing of Welded Fabrications

PAGE 41

THE MAGAZINE OF WELDED FABRICATION

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

Timely, helpful editorial . . . read by more welding men than any other monthly welding magazine

A THOUSAND AND ONE
Complete Units and Combinations

That's what is available to you from Jackson Products' well integrated line of safety products, including head, face, and eye protection for welding and allied industries.

Life Guard hat SH-3, the all-purpose hat for construction and electrical uses.

Fiber Glass hat SH-1, meets the tests for construction workers' safety hats.

Face Shield F-1, firmly held on Safety Hat SH-1 by elastic band.

Visors 15½ by 9" deep in clear plastic, tints of green.

Visor with welding lens (shown on Musketeer)

Visor 15½ by 9" deep of 24-mesh wire screen.

ALL JACKSON SAFETY HATS combine with **FACE SHIELD TYPE 'F-1'**

ALL JACKSON FACE SHIELD VISORS FIT FACE SHIELD 'F-1' (left) and 'MUSKETEER' (below)

Alumihat SH-5 gives excellent protection, is light in weight.

Two pivoted aluminum frame members permit raising visor.

Face shield J-1 shows 6" clear visor.

Metal-bound visors type J-1, 11¼" wide, 8", 6" and 4" deep; in clear plastic, .020", .030" and .040" thick, and in tints of green, .020" only.

Life Guard Cap SC-3, like the SH-3 hat, is made in white, yellow and grey

Cap-and-helmet SCH-1P shows curved shell helmet on SC-2 safety cap.

Cap-and-Goggle shows goggle unit CW-70 pivoted on SC-2 safety cap.

Musketeer Assembly No. 82 on Life Guard Cap SC-4 shows 34-2 visor, medium green.

ALL JACKSON SAFETY CAPS combine with **WELDING HELMETS IN NINE TYPES** with **GOGGLES IN FIVE TYPES** with **'MUSKETEER' FACE SHIELD**

Fiber Glass Cap SC-1, like the SH-1 hat, is made in grey and seven other colors.

Alumicap SC-5, like the SH-5 hat, is made in satin-finished aluminum.

All three styles shown offer choice of three lens holders.

Curved shell helmet H1-AP shows plastic lens holder.

Narrow shell helmet H3-A shows metal lens holder.

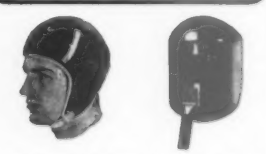
Straight shell helmet H9-A shows plastic lift-front.

Supergoggles WR-70 for welding and GR-70 for grinding; elastic headbands.

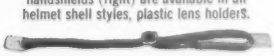
Unigoggle W-60 for welding shows plastic headrest. WR-60 has elastic.

Goggles WR-50 for welding and GR-50 for grinding. Also in headrest types.

Musketeer Headgear Assembly 70-S shows Adjust-O-Lok, spark deflector, and clear visor No. 34-4, .040" thick.



'Winterizers' (left) may be used with all Jackson products shown here. Arc welding handshields (right) are available in all helmet shell styles, plastic lens holders.



Chin Strap for Jackson safety hats and caps.

Welding goggle type BX has plastic headrest and 2 by 4¼" filter lens.

April is National Welded Products Month. See the Welding Show, Chicago, April 7-9 and visit our Booth No. 516.

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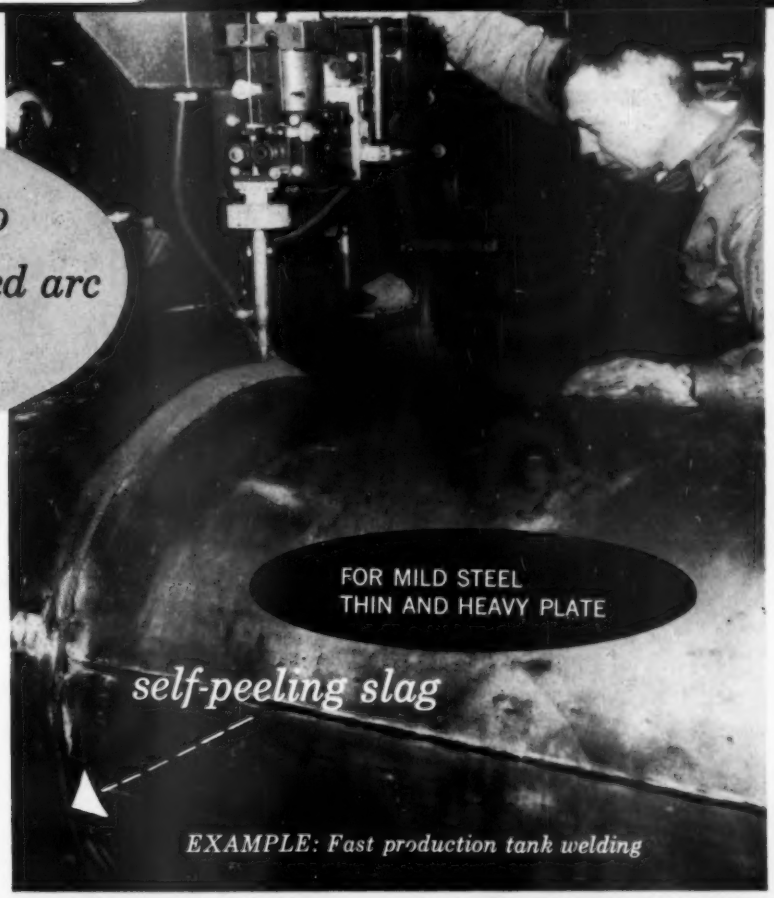

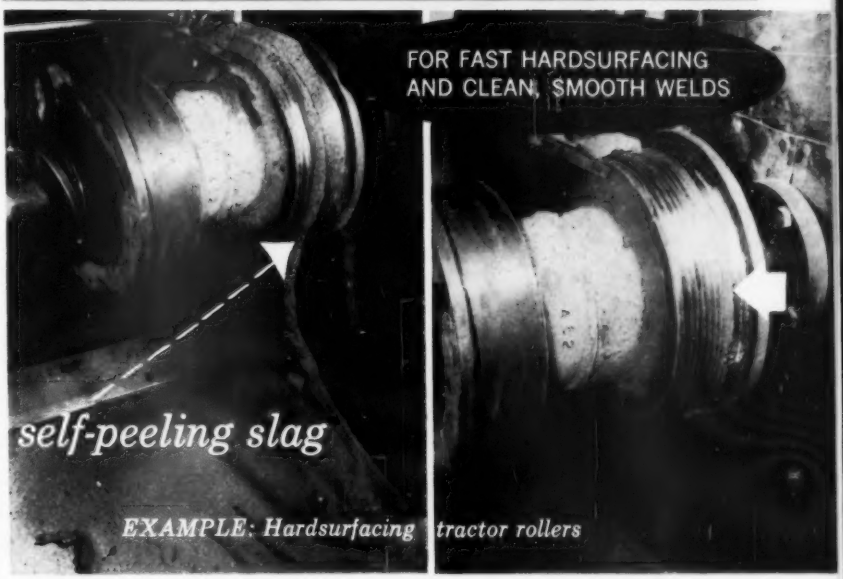

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The U. S. Army Ordnance Michigan Missile Plant, operated by the Missile Division of Chrysler Corporation had problems concerning the handling of the Redstone and Jupiter missiles with their thin-walled skin (aluminum) without damage, such as wrinkling, marring or indenting. Also how to position the missile when being X-Rayed and having certain assemblies added as well as moving the large skin from place to place.

Their solution to these problems was Aronson Rubber Trac-Treds installed on specially built dollies: two (2) Idler double Trac-Treds with rubber treds and staggered to give constant contact with the skin and so positioned as to permit 90 degrees of the skin's surface to be nestled and supported by the treds. These Idlers are placed at either ends of the dolly. The Single-Rubber Trac-Tred Driver Unit, also giving 90 degrees of surface support, is located in the middle of the dolly providing the turning power. The Trac-Tred Driver unit is 110 volt to enable the complete unit to be moved to and worked on anywhere in the large plant.

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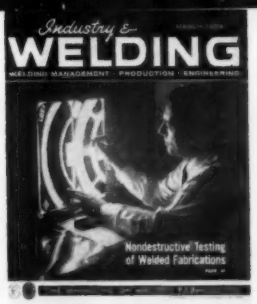
COVER

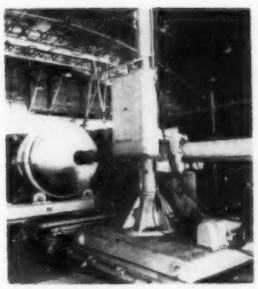
X-ray inspection checks quality of welds at American Chain & Cable Co., Reading, Penna.



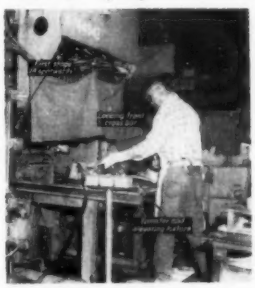
READERS' GUIDE

March, 1959 volume 32 number 3

PAGE 28



PAGE 31



PAGE 35

PAGE 36 38

27 WELDING STAINLESS-CLAD MANGANESE-MOLY STEEL
Two different welding processes and three different types of electrodes are used in fabricating high pressure tanks.

28 HIGH-SPEED FABRICATION OF 120-FOOT GIRDERS
Production line operations keep movements of steel, men and equipment to a minimum; labor delays are cut 30%

31 NEW AUTOMATIC WELDS SPHERES FROM THE INSIDE
It is now possible to weld spheres (and cubes) in thickness up to 12-inch automatically from the inside.

32 AUTOMATIC WELDING BOOSTS PRODUCTION 220%
Light, short welds can be made economically by automatic welding—if you have enough of them.

35 MULTISPOT WELDER MAKES 260 SUBASSEMBLIES HOURLY
Automatic spot welding helps A. O. Smith Corp. keep up with demands for high-production at low cost.

36 AUTOMATIC FIXTURING IS KEY TO PRECISION WELDING
Engineered assembly line for induction soldering and projection welding yields quality, high volume production.

38 SEMI-AUTOMATIC PROCESS WELDS 25% FASTER
Continuously-fed wire coated magnetically with flux and shielded with CO_2 deposits weld metal faster.

41 NONDESTRUCTIVE TESTING OF WELDED FABRICATIONS
A wide variety of new equipment and accessories and improved techniques are available to check just about any weld.

42 HOW TO BUY AND WHERE TO USE NONDESTRUCTIVE TESTING EQUIPMENT
30 experts discuss the applications for nondestructive testing; they explain advantages and limitations of each method.

46 WHERE TO BUY NONDESTRUCTIVE TESTING EQUIPMENT
Names and addresses of the leading manufacturer of nondestructive testing equipment and accessories.

58 NONDESTRUCTIVE TESTING AT WORK
A pictorial presentation of how industry uses testing to save money and keep competitive.

62 PROCEDURES FOR IDENTIFYING STAINLESS WIRES
Increasing use of stainless and development of new alloys makes it increasingly difficult to tell them apart.

64 INSTANT CHECKS ON WELDING CURRENT
Tong testers are a fast way of making sure you are getting specified amperage at all times.

DEPARTMENTS

6 WELDING AT WORK
12 WELDING LIBRARY
14 NEWS OF THE INDUSTRY
19 MEN ON THE MOVE
66 NEW WELDING PRODUCTS*
74 WELDING MANAGEMENT
76 USEFUL FREE LITERATURE*
81 CLASSIFIED ADVERTISING
82 ADVERTISERS' INDEX

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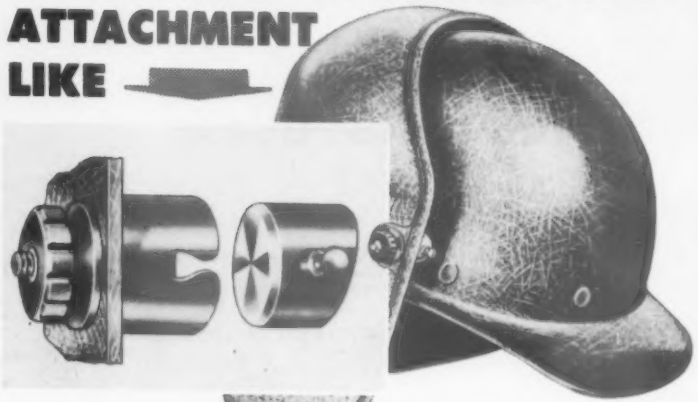

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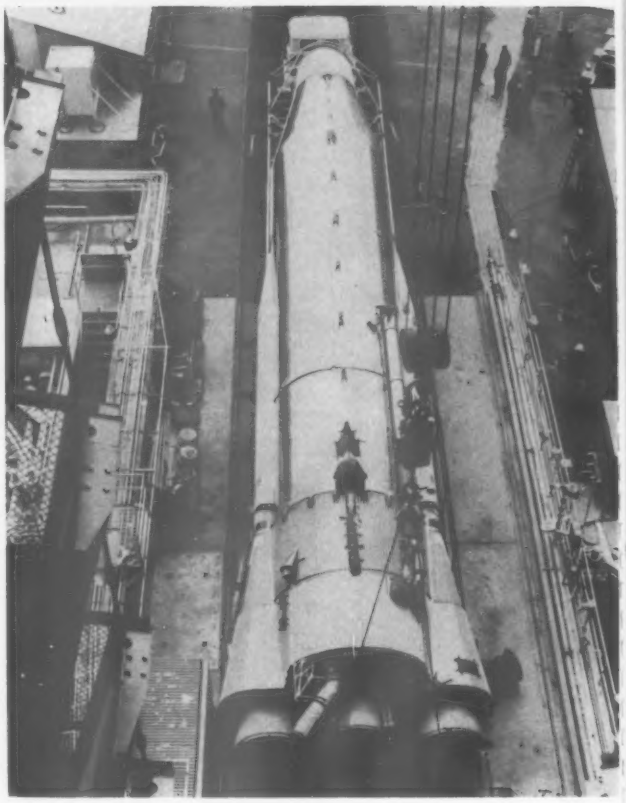
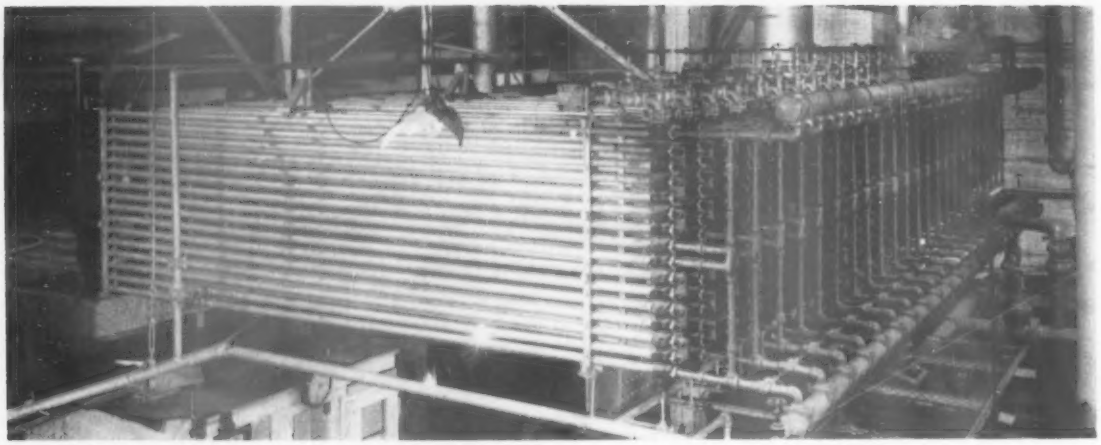


Hull of Atlas missile is welded stainless

NEW YORK, N.Y.: The Air Force Atlas ICBM now in orbit is made almost entirely of stainless steel. Except for the satellite's large single rocket engine (the two booster rockets are detached during initial flight) the entire protective skin of the 85-foot long missile is made of shiny, corrosion-resistant stainless. This was specified for its tensile strength and high temperature- and corrosion-resistance. These characteristics result in a strength-weight ratio which allows designer to use stainless in thin sheets to achieve ultra-lightness with ample design strength.

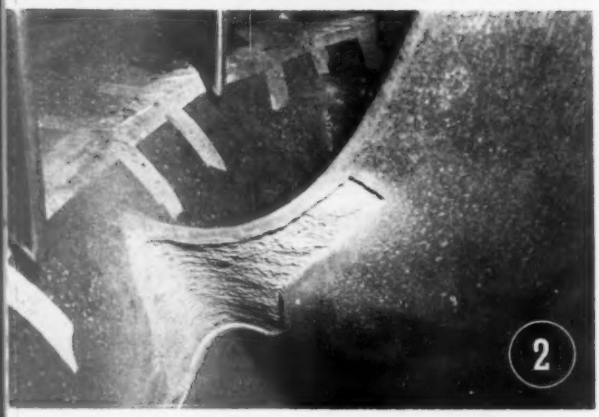
The integral fuel tank-airframe skin is made of rings of thin-gage stainless (0.029 to 0.017-inches thick) welded together to form the tank-skin. Welding is the major method of joining since weight saving is critical.



Welded wrought iron pipe prevents leaks in gas condenser

NEW ORLEANS, LOUISIANA: Ammonia gas fed into this 23-stand double pipe condenser under an average of 175 pounds pressure maintains temperatures from -20°F to 45°F in refrigeration rooms at Pelican Ice Company. Sound, tight welded joints prevent leakage of gas as it is compressed to liquid form.

The 16-pipe high, "off-the-floor" condenser was fabricated of 1¼- and 4-inch corrosion-resistant wrought iron pipe. Produced by A. M. Byers Company, Pittsburgh, the 4-D wrought iron pipe was used for both inner and outer condenser tubing at the Pelican plant which produces 300,000 pounds of ice daily. It houses a 350-ton refrigeration load for a warehouse, an ice cream plant and a food processing plant.



Low heat input welding overcomes turbine erosion problem

OKLAHOMA: Engineers at a large hydro-electric plant performing a routine inspection on a 57-ton turbine found one bucket in imminent danger of cracking from a serious cavitation formation.

The solution was to remove the fatigued metal and weld in stainless steel patches.

While this repair was simple enough, theoretically, it created a two-fold problem. Problem number one was the inaccessibility of the endangered bucket. Grinding equipment of adequate size could not be gotten in. Problem number two was the complexity of the fatigued area, which during welding, would set up enormous stresses that could cause warping and cracking.

By checking with the local technical representative of Eutectic Welding Alloys Corporation, a completely satisfactory repair technique was developed.

First, engineers chalked an outline of the fatigued area, as shown in Photo #1.

Then using Eutec-Chamfertrode (DC), a patented high speed metal-removing electrode, the chalked area was gouged out. The chamfered area (shown in Photo #2) was gouged to an approximate ¼-inch depth in a fraction of the time a mechanical grinding process would require. The metal-removing electrode is used in a standard electrode holder without any auxiliary oxygen equipment.

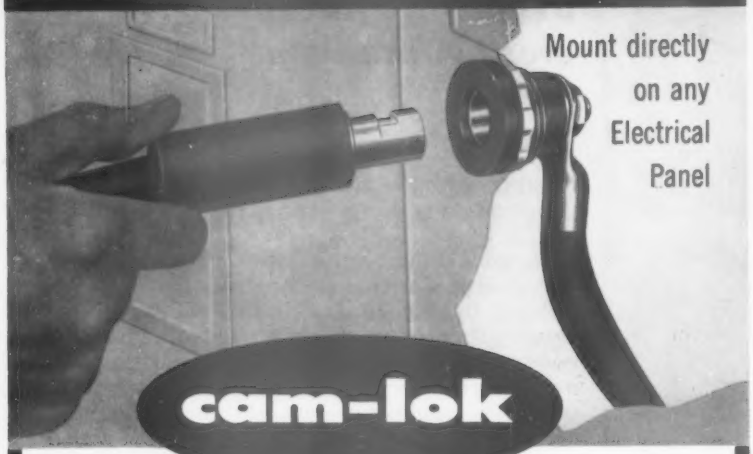
The next problem was that of stress. By using a high quality alloy that provides exceptionally high strength at lowest amperage, heat input could be kept to a minimum, thereby reducing the possibility of warpage or distortion.

To meet these critical requirements, Eutec-Trode 680 (AC-DC), a patented, very high tensile (to 120,000 psi) electrode was used. The electrode is designed for all-position welding of all steels, particularly the medium to highly alloyed grades. The high strength and ductility of the weld deposit is exceptionally resistant to cracking from stress and restraint.

The stainless steel patches were first tack welded in place as shown in Photo #3. To complete the repair, the operator used a stagger sequence, by alternating *between* the stainless patches to prevent stress concentrations. Each welding pass was carefully peened to insure further stress relief.

A small, portable hand grinder was used to smooth the deposit. The finished job, shown in Photo 4, required less than two working days.

New Hi-Impact Plastic Insulated Panel Receptacles and Mating Plugs



Now, you can make fast, positive power connections to any metal panel or housing without special insulating materials. Simply punch out a hole and insert a Cam-Lok self-insulated Receptacle! Uses standard electrical lock-nuts, affords "dead-front" protection. Push in and twist Cam-Lok mating Plug and you've made a locked connection, which can be released quickly.

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Hard surfaced pump sleeves outlast stainless

One of the most striking examples of the effectiveness of hard surfacing is shown in a case history report from Wall Colmonoy Corporation, Detroit.

The accompanying photograph shows two pump sleeves following service in the same Desalta charge pump moving raw crude oil, a fluid known for the extremely abrasive nature of the many foreign particles it carries. The pump sleeve at right was fabricated of Type 316 stainless. This sleeve was removed after 105 days in service. The severe wear encountered is obvious.

The pump sleeve at left was fabricated of carbon steel and overlaid by the company's Sprayweld process. A nickel-base powder alloy containing chromium borides as well as chromium carbides was used. When removed after 13 month service, the hard surfaces sleeve had worn the slight amount shown.

An additional benefit obtained was increased packing life. The packing had been changed 8 times during the 105 days the stainless sleeve was in service. When the hard surfaced part was substituted, the packing was changed just once in 13 months.

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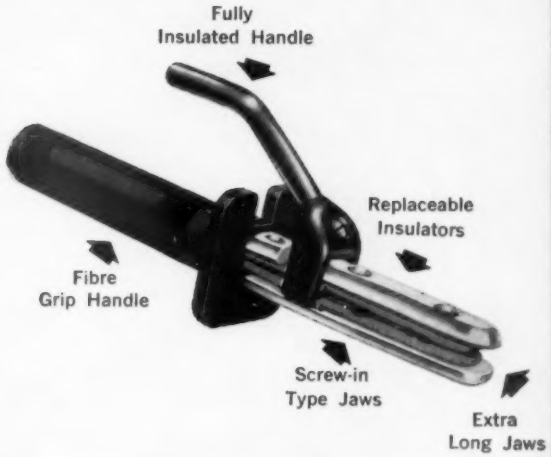

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THE DUROGON-N3 and N3HD

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Victor welding torch Model 100

Victor cutting attachment Model 550-100

Victor welding torch nozzles, Type 13, sizes 0, 2, and 4; (welds to ¼")*

Victor cutting tip, Type 5-101, size 1; (cuts to 1")*

12½ ft. dual welding hose, 3/16" diameter

Spark lighter, goggles, and wrench

*By adding Victor nozzles and tips of larger or smaller capacities to Super-Range unit, you can greatly increase the working range.

VICTOR for welding

VICTOR EQUIPMENT COMPANY

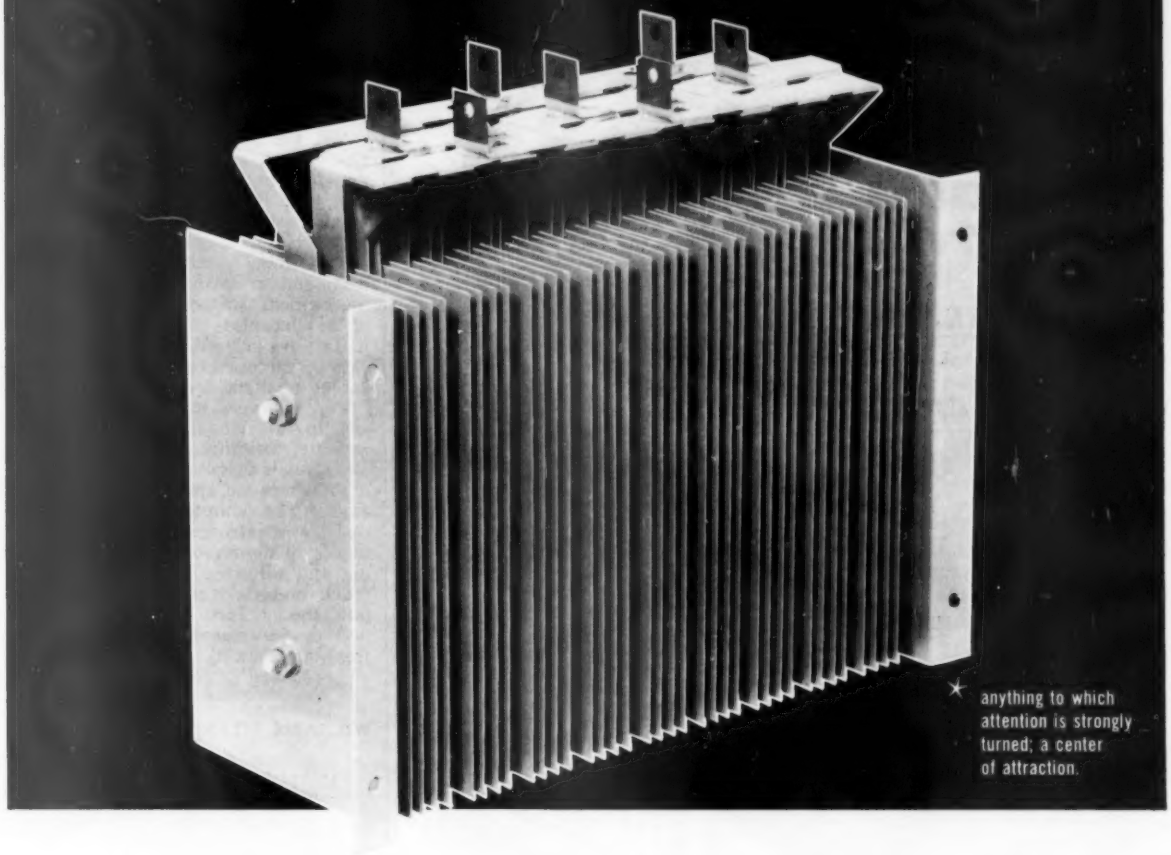
Mfrs. of welding & cutting equipment; high pressure and large volume gas regulators; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines. 54

844 Folsom St., San Francisco 7 • 3821 Santa Fe Ave., Los Angeles 58 • 1145 E. 76th St., Chicago 19

J. C. Menzies & Co., wholly owned subsidiary

For More Information Circle No. 73 on Reader Service Card.

CYNOSURE ★



★ anything to which attention is strongly turned; a center of attraction.

INDEED the center of attraction — The best and longest lasting rectifier ever placed in a welding machine

The mighty heart of the entire line of MILLER GOLD STAR WELDERS is the rectifier stack illustrated above. A MILLER designed, MILLER built and MILLER guaranteed component — one that has proven itself by establishing unprecedented performance records in the only service in which you are interested — arc welding.

We, too, are interested in no other service. For that reason we have built, tested and retested welders utilizing every available rectifier — and every time the answer is still the stack illustrated above.

And the "secret" why this rectifier stack is superior to other similar devices? SIMPLE — MILLER research directed only to a better and better rectifier FOR WELDING ONLY — MILLER quality production control directed toward a uniformly high standard product — MILLER production techniques involving extensive automation and electronic process regulation — and MILLER "know how" gained as the largest producer of rectifier type welders.

For a more detailed treatment of this subject, you are invited to ask for a free copy of "A New Performance Record in Rectifiers," written by our director of research, G. K. Willecke.

miller WELDERS

miller Electric Manufacturing Company, Inc. APPLETON, WISCONSIN

EXPORT OFFICE: 250 West 57th St., New York 19, N.Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

For More Information Circle No. 49 on Reader Service Card.

You can't see it... but it saves you MONEY

HIDDEN CLUTCH DOUBLES gear and motor LIFE...

SANDER-GRINDER

Especially Built for the Welder. Perfect tool for grinding down welds, casting fins and risers. Milwaukee's *exclusive* coaster brake clutch drive absorbs backlash and shocks . . . doubling gear and motor life. Large cyclonic fan and specially designed exhaust ports provide extra ventilating capacity . . . cooler running. Totally enclosed grit-proof, dust-proof trigger switch. Powerful, no-stall MILWAUKEE motor delivers a full 1½ HP *at the spindle* . . . 5000 RPM . . . ball and roller bearings throughout.

See us at Booth No. 900
NATIONAL WELDING SHOW . . . .
Chicago, April 7 - 9th

Find Us Fast In The Yellow Pages
Look under "Tools-Electric"

Milwaukee Electric Tool Corporation
5318 West State Street • Milwaukee 8, Wisconsin

For More Information Circle No. 50 on Reader Service Card.

LIBRARY

of welding

FILLER METALS FOR JOINING

Orville T. Barnett, Metals Research Department, Armour Research Foundation, Chicago, Illinois. January 1959, 250 pages, $7.00. American Welding Society, 33 West 39th Street, New York 18, N.Y.

This book summarizes industrial practice in selecting the proper filler metal for any metal joining situation. It covers all of the ferrous and non-ferrous joining metals. Welding, brazing, and soldering are treated with major emphasis on products for manual and automatic arc welding. Available materials are discussed in terms of applicability, mechanical properties and degree of availability. Where many filler metals are offered for a single application, factors controlling the best choice are outlined.

Ten chapters are devoted to arc welding electrodes. Another on automatic welding of mild and low alloy steels discusses materials in an area where no specifications as yet exist. The chapters on new iron powder electrodes, latest developments in nonferrous metals, surfacing and tungsten electrodes contain much material that has never been published before.

Over 84 experts in the field of joining reviewed portions of the text.

WELDABLE TITANIUM ALLOY

J. P. McAndrew and D. W. Levinson, Illinois Institute of Technology for Wright Air Development Center, U. S. Air Force. June 1958. 33 pages (Order PB 151214 from OTS, U.S. Department of Commerce, Washington 25, D.C., $1.00).

This is a report of research to find a titanium-base sheet alloy having a minimum room-temperature tensile yield strength of 130,000 psi, which would be weldable without requiring post-welding heat treatment to restore ductility or strength.

These alloys were prepared and evaluated: Ti-13Sn-10Zr; Ti-13Sn-10Zr-2A1; Ti-13Sn-10Zr-4A1; TI-22-Mo-8Mn; Ti-17.5Mo-10Mn; and Ti-22Mo-8Mn-3Cr. These were selected primarily from strength considerations and, secondly, in the hope that the first three would be all-alpha and the last three all-beta alloys.

Alloys containing molybdenum were unsatisfactory. Of the three alpha alloys, Ti-13Sn-10Zr-2A1 was marginally acceptable, but showed sensitivity to thermal history. The strengths of the two other alpha alloys were lower than desired; both were sensitive to thermal history.

The report suggests that Ti-13Sn-10Zr-2A1 be investigated further, and that additional work be done on new compositions.

THIS WAY ...for FASTEST

WELD GRINDING

SIMONDS ABRASIVE CO.

DOUBLE XX

Reinforced Resinoid
Depressed Center Wheels

Fastest by far . . . of the three types of depressed center wheels that Simonds makes! Double XX is made like a conventional grinding wheel with *maximum* amount of abrasive grain — doubly reinforced for extra strength and safety. Lightweight, rigid type, for general use, especially grinding welds.

Simonds also makes Fibrex Wheels, slightly flexible, for the lighter jobs and stainless steel. Also Simex Red Wheels, extra strong for heavy duty use. Send for catalog ESA-244 describing all three.

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For More Information Circle No. 62 on Reader Service Card.

International Acetylene Association Meets In New Orleans

Safety and acetylene chemistry sessions and Morehead Medal Award highlight the IAA's 61st annual convention on March 9th and 10th

NEW ORLEANS, LOUISIANA: A technical session on safety with major emphasis on safe practices in the use of oxyacetylene processes and equipment will be the feature of one of the sessions of the annual convention of the International Acetylene Association to be held on March 9th and 10th at the Hotel Roosevelt.

The session, to be moderated by H. R. Morrison of Linde Company, a division of Union Carbide Corp., will begin at 9 a.m., Tuesday, March 10th, and will include a panel discussion by safety experts from various member companies as well as by representatives from the educational field and the National Fire Protection Association.

The meeting will also include a technical session on acetylene-based chemicals. The session will include a presentation on the Fortier plant of the American Cyanamid Company at New Orleans, as well as a report and open forum discussion on proposals by the IAA's Transmission Committee for an industry-wide guide covering acetylene transmission systems. W. Y. Scofield, Air Reduction Co., Inc., is chairman of the latter committee.

Principal speaker at the opening-day luncheon on March 9th will be John R. Callahan, editor-in-chief of CHEMICAL ENGINEERING, who will demonstrate several new products of acetylene-based research which are currently being introduced to the commercial market. He will discuss other product applications still in the development stage.

Linde's Kirk wins Morehead Medal

At the Morehead Medal Dinner the same evening, presentation will be made to this year's recipient of the Association's annual award to the individual who has done the most to advance the industry or the art of producing or utilizing calcium carbide or acetylene.

This year's award will be presented to Stanley B. Kirk, former president of Linde Company, a Division of Union Carbide Corporation. In addition to serving as Linde's president from 1944 to 1952, Mr. Kirk was elected a vice-president of the Union Carbide Corporation in 1945. At present, he is a director of Union Carbide Canada Limited and chairman of the Pyrofax Gas Corp.

Linde Ships King-Sized Gas Producing Equipment

PITTSBURG, CALIFORNIA: Six flatcars of oxygen- and nitrogen-generating equipment—the largest single rail shipment of special industrial gas producing equipment ever sent across the nation by Linde Company, Division of Union Carbide Corp., to the Pacific Coast—arrived recently at the building site of the firm's new multi-million dollar plant near here.

The equipment will be installed by Kaiser Engineers, Division of Henry J. Kaiser Company, Oakland, Calif., which has been awarded a contract for the final construction phase of the plant.

Upon completion in early 1960, the plant will produce 300-tons of liquid oxygen and nitrogen daily and will serve a nine-state area.

COMING EVENTS

March 16-20: 11th Western Metal Exposition and Congress, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles.

April 7-10: 1959 AWS Welding Show, International Amphitheatre, Chicago, Ill.

May 4-7: Annual NWSA Convention, Fairmount Hotel, San Francisco.

November 2-6: 41st National Metal Exposition and Congress, International Amphitheatre, Chicago.

Lincoln

WELDYNAMICS

NEWS ABOUT ARC WELDING AT WORK CUTTING COSTS

AEROGLIDE TRIMS WELDING COSTS 1/3 ...IMPROVES PRODUCT QUALITY

Structural parts are welded faster and easier with Jetweld.

Like many other manufacturers, Aeroglide Corporation of Raleigh, North Carolina, found themselves caught in a price-cost squeeze last year.

Aeroglide is one of the largest manufacturers of produce handling equipment and grain driers. All the equipment they build is welded and much of the welding is on sheet metal. Their biggest cost problem involved the sheet metal welds. Burn-through and spatter were eating up shop time and profits.

John Wyatt, Aeroglide's Shop Superintendent, "Our whole shop is more efficient because of improved welding methods."

John P. Wyatt, Jr., Aeroglide's shop superintendent and James F. Kelly, President, decided to seek outside help. They invited Kirk Sterling, a welding engineer with Lincoln's Charlotte, N.C. office to help them make a survey of Aeroglide's welding operations.

Working closely with Mr. Wyatt, Sterling made a careful analysis of their welding jobs. The burn-through and cleaning problems were solved with a switch to Fleetweld 37 electrodes which are specially designed for sheet metal welds. Greater production efficiency on heavier structural members was achieved with iron-powder Jetweld electrodes.

Mr. Sterling also conducted a five-day welding clinic which was voluntarily attended by Aeroglide's weldors and shop supervisors. Higher shop efficiency resulted from a better understanding of welding procedures as a result of the clinic.

The total effect—a 33% cut in welding costs.

Jim Kelly, Aeroglide's youthful president, commented, "The Lincoln people have done us a great service. Big industries can go to their suppliers and demand the products they need. Companies like ours depend on our suppliers to show us how to get the most out of what's available. Lincoln has helped us build a better product . . . and made a stronger Lincoln customer.

Aeroglide grain dryers, easier to assemble, sturdier and more efficient with welded construction.

The LINCOLN ELECTRIC CO.
Dept. 1849, Cleveland 17, Ohio
The World's Largest Manufacturer
of Arc Welding Equipment

For More Information Circle No. 45 on Reader Service Card.

The new rugged, powerful Riley Pulverizer is an outstanding example of advanced functional design. A key to this Riley pioneering achievement is the use of tungsten carbide to increase the life and efficiency of pulverizer parts. Result . . . years of uninterrupted performance . . . minimized shut-down time . . . lowest operation costs.

Needless to say, pulverizers take tremendous punishment, but these are definitely built to "take it." *Riley specifications assure prolonged service.* The tungsten carbide facings are brazed to the pulverizer parts with Silvaloy—producing joints *as strong and dependable as the metals joined.*

Silvaloy Brazing Alloys and APW Fluxes are helping to speed production, lower costs and improve brazing results in many fields. Call your nearest Silvaloy Distributor for information or assistance.

AMERICAN PLATINUM & SILVER DIVISION
439 N.J.R.R. AVENUE • NEWARK, N. J.

STOKER CORPORATION

Riley pulverizers have been selected by many of the leading public utility and industrial companies for pulverizing coals of high grindability and abrasive high ash coals. The use of tungsten carbide as a facing for the pulverizing elements assures low maintenance, long continuous periods of operation, and sustained fineness with high availability.

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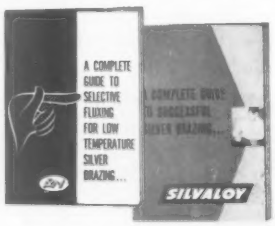


Two complete reference manuals for low-temperature silver brazing and fluxing are available upon request. Send for either one or both. ★ ★ ★ ★ ★ ★ ★

For More Information Circle No. 10 on Reader Service Card.

Introducing the NEW MODEL 1-A SEVER-ALL Machine... CUTS AT 3 to 6 SECONDS PER SQUARE INCH—ECONOMICALLY

MANY EXTRA FEATURES AT A DELIVERED COST UNDER $500

You get the cut quality and capacity of machines nearly three times as expensive when you use the new Model 1-A SEVER-ALL oscillating dry abrasive cut-off machine. Available from your distributor's stock. Here's why the #1-A SEVER-ALL is ideal for industrial and machine shop operations:

BIG CAPACITY • Up to 2″ square solids, 3½″ O. D. pipe and tubing, 3″ angle iron, and 4″ channels . . . of cold rolled, stainless, and alloyed steel; cast iron; and nonferrous metals. Wheel oscillation, an exclusive feature in this price range, provides this *above-average* capacity.

SPEED • Cuts a 2″ x 2″ hardened steel bar in 16 seconds . . . other shapes and sizes at 3 to 6 seconds per square inch.

QUALITY • Clean, smooth cuts, even on large sections, because wheel oscillation provides cooler cutting.

ECONOMY • In addition to low initial cost, the Model 1-A SEVER-ALL is inexpensive to operate . . . occupies minimum floor space . . . requires little or no set-up time . . . eliminates annealing costs . . . gives more cuts per wheel because of oscillation.

SIMPLICITY • Just two SEVER-ALL cutting wheel specifications will do *all* your SEVER-ALL cutting jobs. A positive, screw-type vise holds all regular shapes, and an adjustable work stop provides speed and accuracy.

ANGLE CUTS • Optional accessory permits cutting angles up to 45° in either direction.

NEW SEVER-ALL AVAILABLE FROM DISTRIBUTORS

Very likely your own distributor already stocks the Model 1-A SEVER-ALL machine and wheels. If not, let us know, and we'll give you the name of your nearest SEVER-ALL distributor. Also, we'll be glad to send you complete details on this new machine. Just ask for **Bulletin DH-106.**

ALLISON-CAMPBELL DIVISION AMERICAN CHAIN & CABLE

ACCO

925-S Connecticut Avenue, Bridgeport 2, Conn.

For More Information Circle No. 6 on Reader Service Card.

CUT GLOVE COSTS Due to Broken Seams!

AO Drednaut Welder's Gloves

NO SEAMS ACROSS FINGERS! That's why this American Optical Gunn-type Glove provides maximum resistance to wear, more comfort — longer life! Leather is specially chrome-tanned split cowhide — tough but flexible. The flat, double-stitched seam at base of fingers is more comfortable than an inverted seam — and it's a feature to look for. One-piece back, wing thumb. 14″ long overall. Has back liner for added protection and comfort.

HERE ARE 3 MORE FAVORITES

From AO'S Complete Line of Quality Specially Chrome-Tanned Split Cowhide Gloves

SC5X163

Very resistant to heat. Protects on gas welding and heaviest amperage electric welding. One-piece base and palm. Welted at all vulnerable seams for added strength. Extra heavy lining on back of hand. 14″ long.

SCTX100

Gunn cut, one-piece back. Wing thumb. Double thickness of leather on first finger and thumb. Lined on back of hand from wrist to fingertips. Full gauntlet. 14″ long overall. Flat seam at palm base.

SC3013

Leather patch on back of hand gives added protection against sparks and molten metal. Thumb and first finger reinforced with leather patch. Reinforcing leather strap around thumb. Full gauntlet. 14″ long.

Always insist on AO Trademarked Safety Products

American AO Optical COMPANY
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASS.
Safety Service Centers in Principal Cities

Your nearest AO Safety Products Representative can supply you

For More Information Circle No. 9 on Reader Service Card.

MEN ON THE MOVE

in the welding industry

Paxton

MacKenzie

Holder

Tune

APPOINTMENTS:

The appointment of **Charles F. Paxton** as assistant general sales manager has been announced by *Weltronic Company*, Detroit.

Gerald C. McKenzie has joined *Smith Welding Equipment Corp.*, Minneapolis, as general sales manager. Announcement was made by **L. L. McBurney,** president.

W. B. Moen, assistant director of metallurgical research at *Air Reduction's Research Laboratories*, Murray Hill, N. J., has been named manager of engineering for the newly formed *Special Products Department* of the company at Union, N.J.

Dr. C. R. Castor has been named western sales engineer for Crystal Products and Rare Gases by the *Linde Company, Division of Union Carbide Corp.* His territory includes the area west of the Rocky Mountains, with headquarters in Los Angeles.

Appointment of **George R. Gent** to the newly created post of manager of welding, brazing and soldering product sales, was announced by *Aluminum Company of America.*

The appointment of **Frank U. Hayes** as president and general manager of *Sperry Products, Inc.* has been announced by **J. B. Farwell,** former president and general manager who will continue as Board Chairman and in a consulting capacity.

The Change-O-Matic Corporation, New York City, manufacturers of automatic work clothes dispensers, has appointed **Miles Harrison** as its director of advertising.

I. J. Karassik has been appointed consulting engineer and manager of planning for the *Worthington Corporation's Harrison Division.* He will act as consulting engineer to all departments in that division.

John H. Holder has been elected president of *Contour Marker Corp.*, Compton, Calif.

Appointment of **Robert Holscher** as design engineer in charge of research and development has been announced by *Tec Torch Co., Inc.*, Carlstadt, N.J.

Nielsen

Hinz

Rankin Manufacturing Co., Alhambra, Calif., has announced the appointment of **Clarence A. Nielsen** to the position of district manager in charge of sales in the Northeastern section of the United States and Canada with headquarters in Cleveland, Ohio.

A. C. (Art) Hinz, has been appointed supervisor of sales and engineering for Southeastern Michigan by *Ross Operating Valve Co.*, Detroit.

The following new plant appointments have been made at *American Chain & Cable Company's Page Steel & Wire Division* in Monessen, Pa.: **E. M. Spadafore,** assistant plant manager; **V. J. Dobos,** wire mill superintendent, and **L. R. Wetzel,** superintendent of coating and heat treating department.

Tweco Products, Inc., has reassigned three of its district managers. **Fred Flint** will now serve as West Coast District manager. **Tom Burke** assumes new responsibilities in an enlarged territory as district manager of the North Central territory. **Glenn E. Smith** becomes district manager of the South Central District.

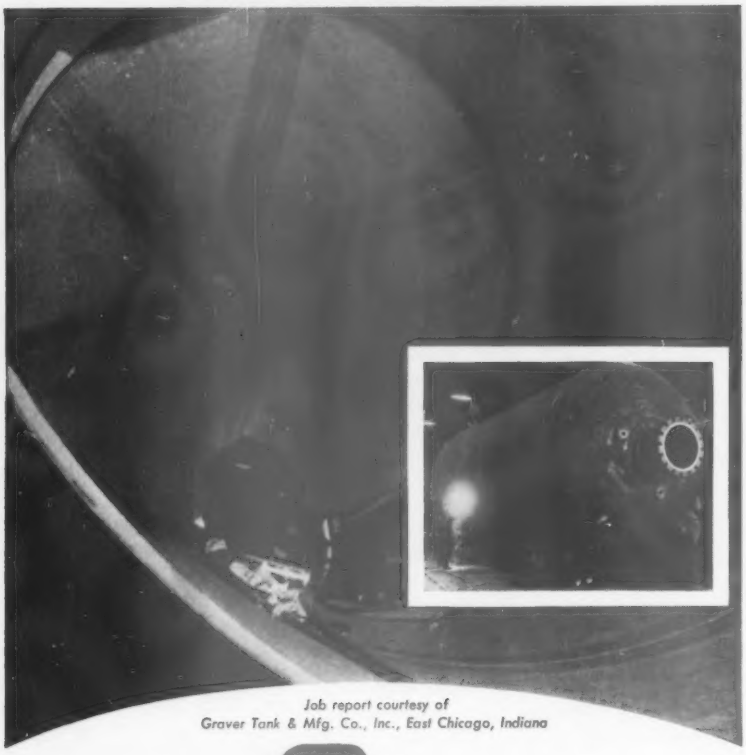
PROMOTIONS:

Raymond H. Tune has been named sales manager at *Atlas Welding Accessories, Inc.*, Detroit. He will head sales of the company's manufacturing and wholesale jobber sales divisions.

The promotion of seven men to major positions on the sales and technical service force of *Eutectic Welding Alloys Corp.*, Flushing, New York, has been announced. **L. D. Richardson,** former assistant general sales manager, has been named assistant vice president and field sales manager. Six men promoted to the position of field service manager are: **Theodore C. Schmidt,** eastern Michigan; **Richard E. Saylor,** western Michigan and northern Ohio; **Clifford E. Kersker,** Virginia, North and South Carolina; **William S. Wells,** Georgia, Alabama, Florida and Tennessee; **Melvin F. Holder,** midwestern states, and **Robert O'Gar,** Pacific Coast States.

continued on page 20

When stainless welds must be free of microcracks



Job report courtesy of
Graver Tank & Mfg. Co., Inc., East Chicago, Indiana

WELD WITH ARCOS

STAINLESS ELECTRODES

This 93,400-lb. 3500 cu. ft. digester is installed at Finch, Pruyn and Company, Inc., manufacturers of printing and converting papers. It converts hardwood into paper pulp using highly corrosive acids at high temperatures, and pressures of 200 psig. The digester is made of Type 316 ELC 20% stainless clad on ASTM A-212 Grade B firebox steel. To assure sound, long-life corrosion-resistant welds, three grades of Arcos CHROMEND Electrodes were used. All welding was manual. The resultant welds were completely free of micro fissures or cracks—more proof why Arcos weld metal is used so widely to combat destructive and costly corrosion. Write for an Arcos Stainless Application Chart. ARCOS CORPORATION, 1500 South 50th Street, Phila. 43, Pa.

For More Information Circle No. 20 on Reader Service Card.

MEN ON THE MOVE

continued

Muller

Brickett

PROMOTIONS:

Dr. Albert Muller, assistant to the president of *Air Reduction Sales Co.*, the industrial gases and welding products division of *Air Reduction Co., Inc.*, has been appointed vice president of that division.

James A. Brickett has been appointed sales manager of *Arcos Corporation*, Philadelphia manufacturer of welding rods and electrodes. He was formerly assistant sales manager.

Five field promotions have been announced by *National Cylinder Gas Division of Chemetron Corp.* **Russell C. Rothweiler** moves from the firm's branch office in Grand Rapids to manage its district office in Kansas City, Kan. **R. C. Weiss,** former branch manager in Billings, Mont., is the new manager of the Grand Rapids office. He is replaced in Billings by **C. E. Bodin,** formerly in the company's St. Paul, Minn., office. Also announced is the promotion of **Paul R. Greiling** to assistant manager in the company's Chicago sales district. His previous position as sales assistant for the midwest region will be filled by **Donald J. Thor.**

New president of *Denison Engineering Division, American Brake Shoe Co.*, Columbus, Ohio, is **Paul W. Norris,** formerly vice president and general manager.

Jack B. Laramy has been appointed manager of sales of the *Worthington Corporation, Harrison, N.J., Division.*

William B. Ilke has been appointed to the position of sales manager, *Wright Hoist Division, American Chain & Cable Co., Inc.*, York, Penna. He continues as sales manager of *ACCO's American Chain Division* in York.

RETIREMENTS:

Ralph M. Johnson, vice president of *Norton Company,* has retired as director sales. He was re-elected a director and vice president and will be retained as a consultant for one year. He also retired as director of *Behr-Manning Company,* a Norton division.

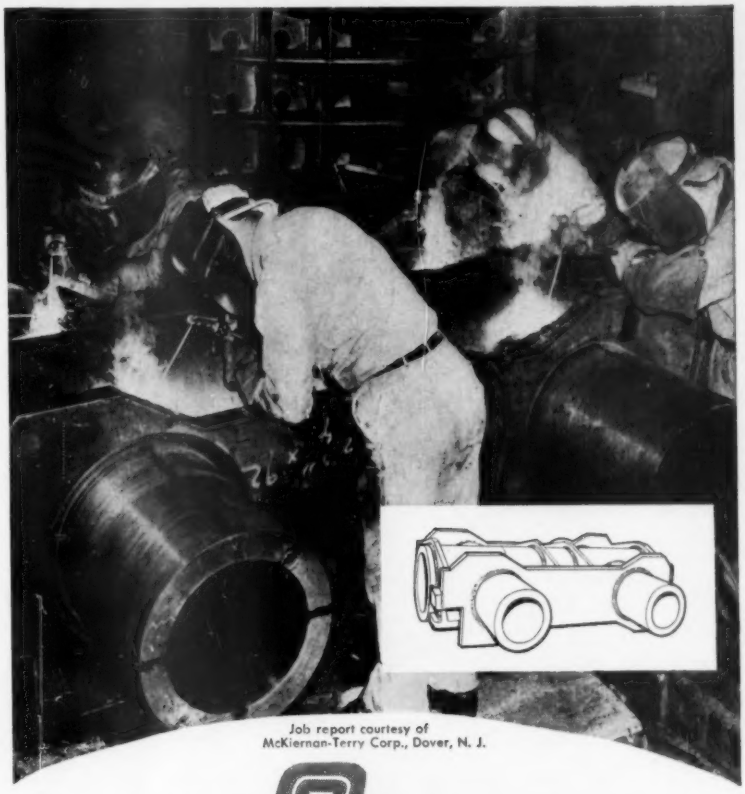
ELECTIONS:

Claude E. Monlux of *Linde Company, a division of Union Carbide Corp.* (above left), was elected president of the *Compressed Gas Association, Inc.,* at that group's 46th annual meeting. Other officers elected include **George C. Cusack,** *Pure Carbonic Co., a division of Air Reduction, Co., Inc.,* 1st vice president (above, second from left); **D. M. Horner,** *Harrisburg Steel Co., a division of Harsco Corp.* 2nd vice president (second from right), and **Franklin R. Fetherston** who was re-elected secretary-treasurer (above, right).

DEATHS:

John E. Taylerson, 43, manager of engineering service, Linde Company, Division of Union Carbide Corp., was killed in an airliner crash at New York's LaGuardia Field early in February. His wife, Florence, was killed with him in the crash. Four children survive.

When low alloy weld requirements are as *critical* as these

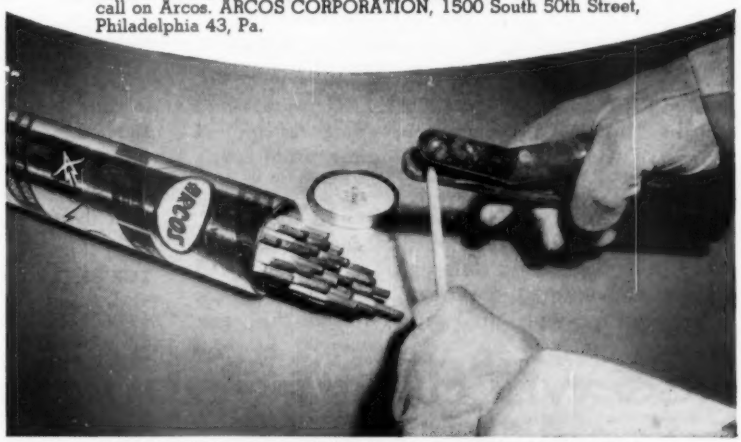


Job report courtesy of McKiernan-Terry Corp., Dover, N. J.

WELD WITH ARCOS

LOW HYDROGEN ELECTRODES

This crosshead weldment—part of a Navy steam catapult for launching jet fighters—must withstand the repeated powerful surges of steam under high pressure. Arcos Tensilend 80 electrodes were used to weld the SAE 4130 low alloy steel. After progressive magnaflux checking, and proper stress relieving, all welds were found to meet the high strength and toughness required for this kind of service. For the *right* weld metal—for the *right* welding techniques—for your tough welding problems—call on Arcos. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.



For More Information Circle No. 12 on Reader Service Card.

Tack welding cast iron cones to carbon steel vortex tubes of gas scrubber. Ni-Rod "55" Electrodes make ductile, crack-free joints. Scrubbers made by The Aerotec Corp., Greenwich, Conn.

Weld cast iron to carbon steel...no preheat... no cracking...with Ni-Rod "55" Electrode

Joints were cracking up – between cast iron cones and carbon steel tubes in gas scrubbers like this one.

Welds made with carbon steel electrodes were just too brittle. They cracked when slag was chipped away. They sometimes broke entirely from rough handling in shipping.

Then – Aerotec weldors switched to Ni-Rod "55"* Electrodes, specially developed by Inco for welding cast irons. And what a difference – no more cracked welds . . . no more preheating . . . good penetration. And Aerotec finds that with Ni-Rod "55", any weldor of normal skill can do a better job.

Get trouble-free welds between cast iron and ferrous or non-ferrous metals – with Ni-Rod "55" Electrode, available from most distributors.

You'll see a lot of ways other shops have pared costs in Inco's booklet, "Repair Cast Iron Parts Quickly and Easily". Yours for the asking.

*Registered trademark

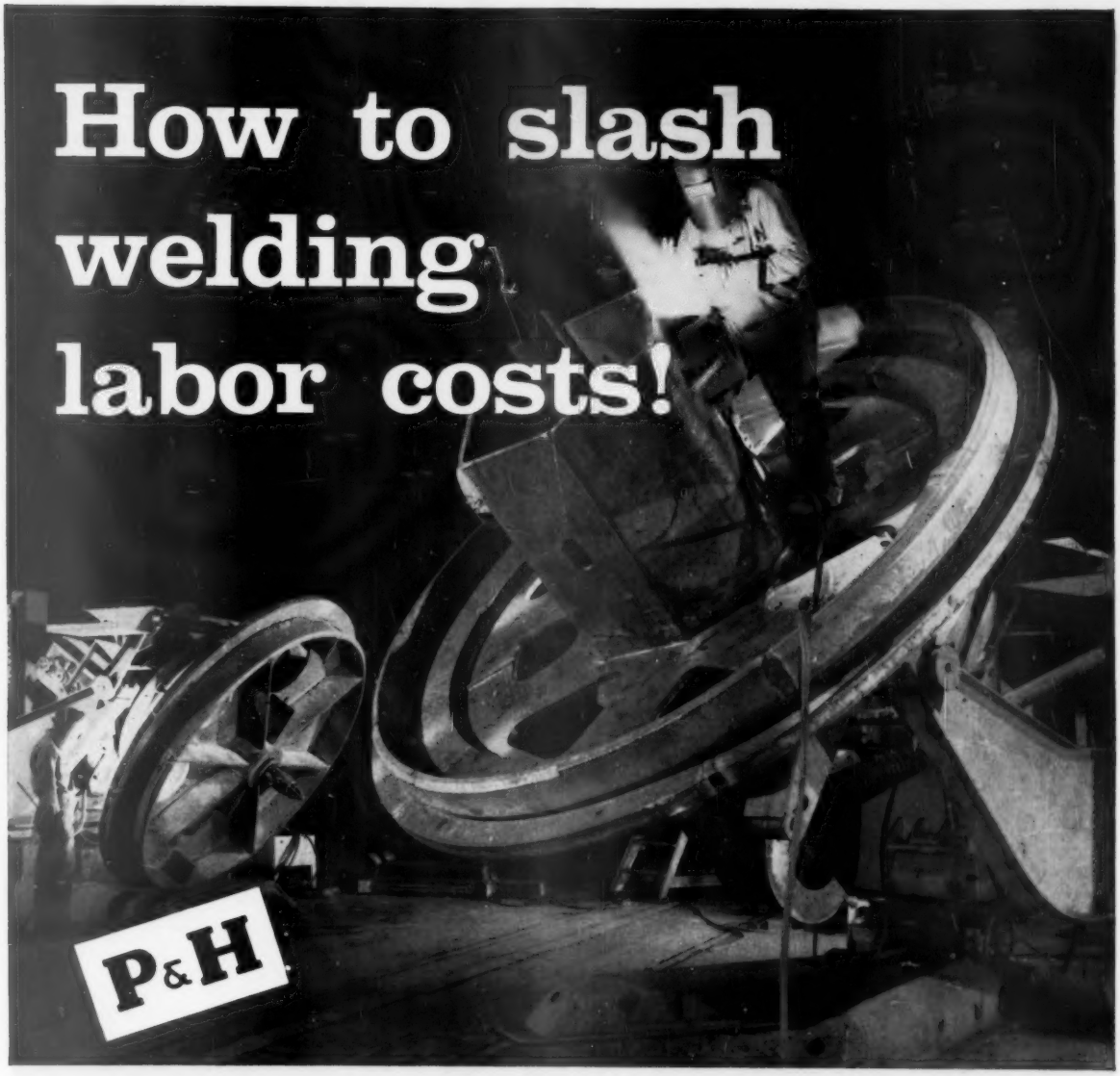
THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street INCO New York 5, N. Y.

INCO WELDING PRODUCTS

electrodes • wires • fluxes

For More Information Circle No. 40 on Reader Service Card.



Mechanize your weldment handling with P&H Welding Positioners

P&H Welding Positioners can often cut labor costs in half by providing faster, safer, *mechanized* weldment handling. With these modern machines, operators merely press a button to quickly spot the work so that all welds are made downhand — in the natural position.

Downhand welding pools more evenly, permits the use of larger, "hotter" rods — frequently cuts the number of passes from 3 to 1.

As a result, you get more arc-time *plus* better welds. Your weldors turn out more work each day and like it — they don't have to work in cramped, awkward positions that reduce efficiency. You eliminate waiting for cranes, and the use of extra helpers for repeated repositioning.

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Cadet	703 (POL)	Acety.	30#	400#	Red
Cadet	703 (Comm'l)	Acety.	30#	400#	Red

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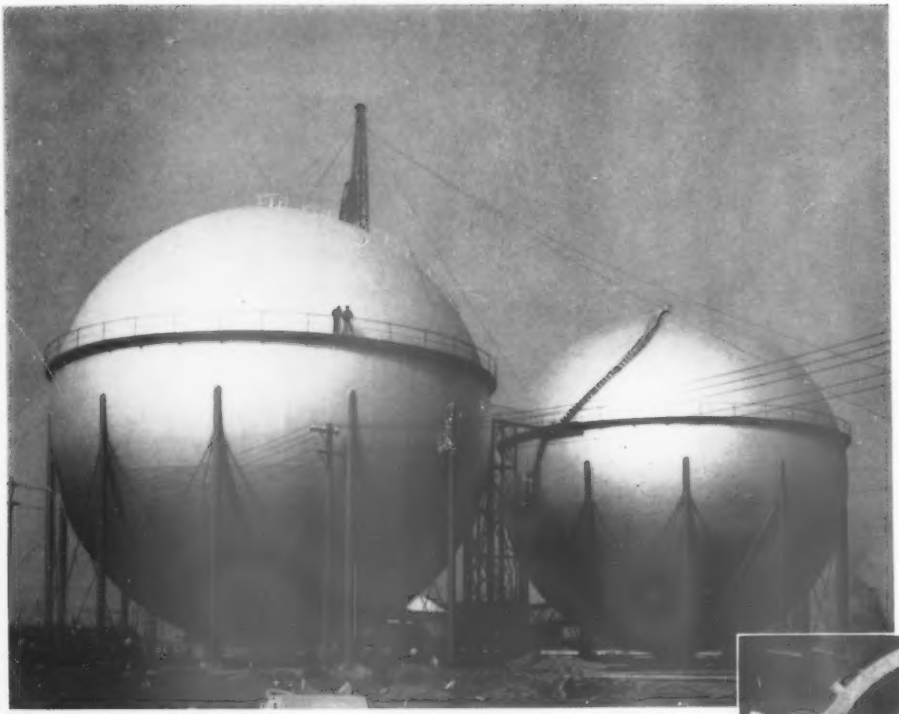

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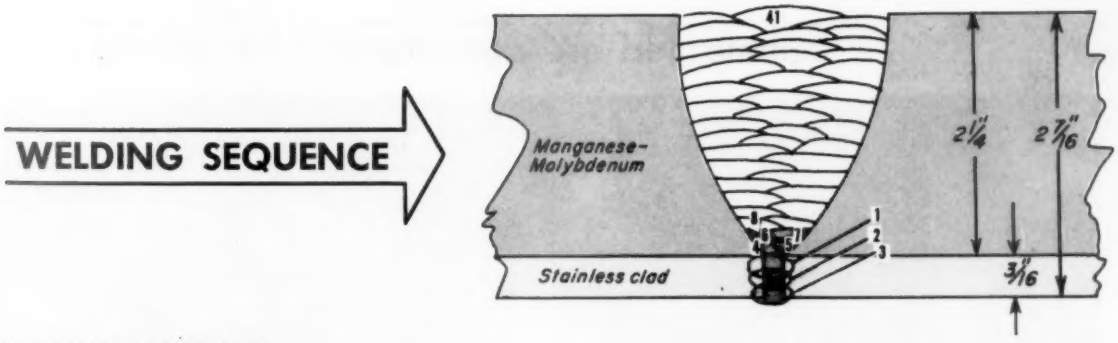


WELDING PROCEDURE

MANUAL					AUTOMATIC	
PASSES	ELECTRODES TYPE	DIA. IN.	CURRENT	VOLTAGE	PASSES 8 THRU 41 (SUBMERGED ARC)	
1	309 LIME	5/32	140	....	ELECTRODE	(MILD STEEL ½ MOLY)
2	316 LIME	3/16	190	....	AMPERAGE	575 - 600
3	316 LIME	3/16	190	....	VOLTAGE	35
4	8016	1/8	100	20	FLUX	ALLOY
5	8016	3/16	185	25	SPEED	17" PER MIN.
6	8016	3/16	185	25		
7	8016	3/16	185	25		

How To Weld 2 7/16-Inch Thick Stainless-Clad Mn-Mo Steel

IN BRIEF: Two different welding processes and three different types of electrodes are used in fabricating high pressure tanks.

IT'S HARD ENOUGH just to weld manganese-molybdenum steel clad with stainless. But, it's even more difficult when you're fabricating high pressure tanks from this material.

Alloy Fabricators, Division of Continental Copper and Steel Industries, Inc., Perth Amboy, N.J., discovered that when they built several oil autoclaves for a perfumery.

Alloy Fabricators used two different welding processes. These included three types of coated electrodes used manually, and submerged arc. Since thorough inspection is required for this weld joint, radiography and dye penetrant tests are made frequently.

Design: To be competitive when bidding on this job, Alloy Fabricators gave serious thought to the material to be used for the tanks that operate at 2,000 pounds pressure at 650°F. Because this heat and pressure speed corrosion, Alloy Fabricators chose A302 Grade B, Type 316 clad as the base material. From their design analysis they knew this high tensile steel with a minimum parent tensile strength of 80,000 psi would meet all specifications.

It wasn't enough to select the material. Alloy Fabricators still had to make the tank economically. This is how they did it:

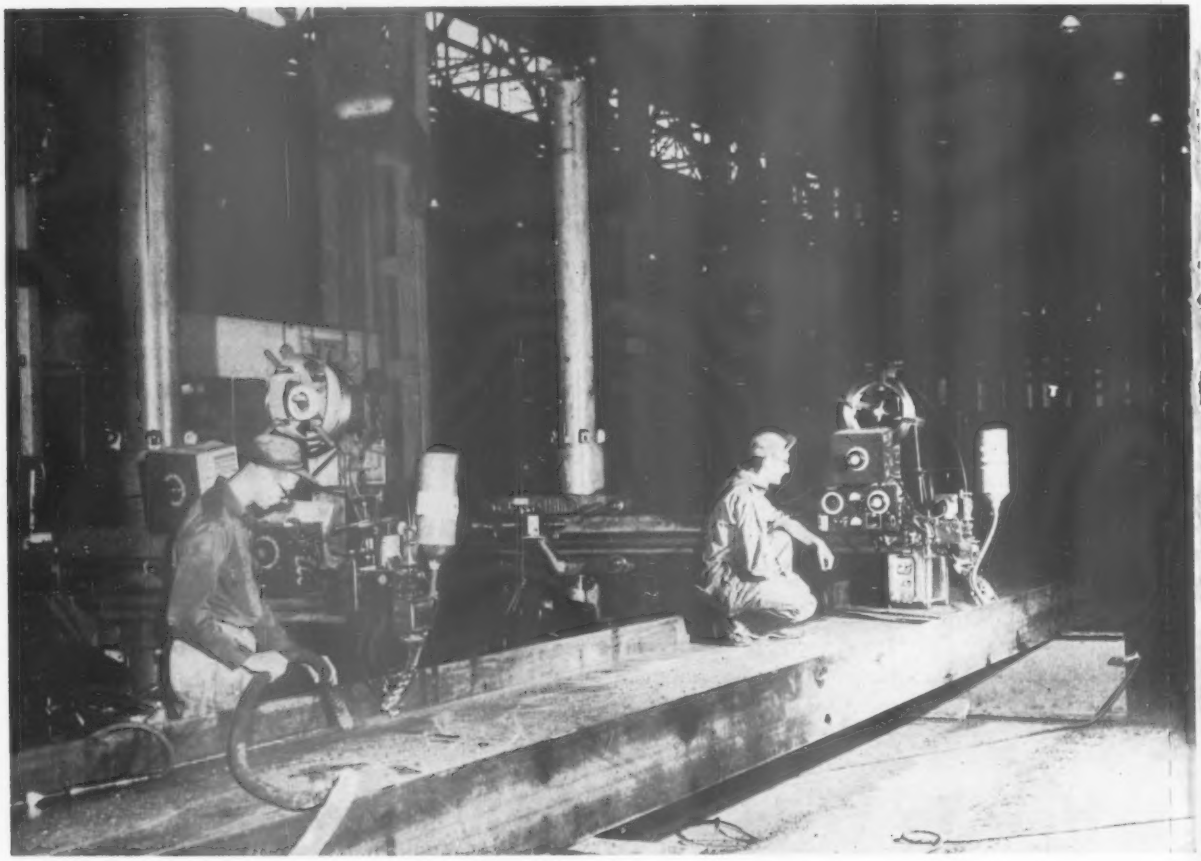
1. They purchased ellipsoidal flanged and dished heads and a rolled-up unwelded cylindrical shell. The material: A302 Grade B, Type 316 clad made up of 2¼ inch manganese-molybdenum plate, clad with 3/16 inch stainless, making a combined thickness of 2-7/16 inches.

2. Alloy Fabricators then prepared all welded joints by machining. Deep standard J-groove joints (see detailed sketch) were used on the longitudinal seam as well as on circumferential welds used to join heads to the tank.

3. They fabricate their own stainless nozzles and manholes. These are fitted and welded to the dished heads as a subassembly. All the

continued on page 60

Submerged arc equipment, two special fixtures



TWO AUTOMATIC submerged arc welding set ups are used at the same time to make fillet welds on each side of the girder in one pass. Welding speed is about 25 ipm.

MECHANIZED submerged arc welder is used to make single pass welds on each side of stiffeners; it steps up job about 90 percent over manual arc welding; adequate penetration is no problem.

and production-line set-ups make possible . . .

High-Speed Fabrication Of 120 Ft. Girders

IN BRIEF: Production line operations keep movements of steel, men and equipment to a minimum; labor delays are reduced 30 percent.

AN INTEGRATED PRODUCTION LINE system of welding bridge girders has been developed by the R. C. Mahon Company, Detroit. According to J. R. (Ray) Stitt who heads welding research at Mahon, the production methods make weldments for bridges less costly and provide quality welding with a minimum of distortion.

Stemming from a long-run task of producing fabricated structural steel girders for bridges on Ohio's Conneaut-to-Cincinnati freeway, the system proves that such gigantic weldments can be made on a production line. This further reduces the cost of such weldments which is already only 85 percent that of other joining methods.

The new Mahon system teams up overhead cranes with two special universal fixtures—one of them over 100-feet long—and both automatic and semi-automatic submerged arc welding. The semi-automatic welding is done with a new, mechanized version of a manual submerged arc welding method.

Welds are made in the unrestrained condition wherever possible to minimize and balance residual stresses.

Success of the operation depends on balancing out manpower, materials and operations, says J. J. Kennedy, plant manager. All movements of steel sections, men and equipment are minimized for efficiency—with provisions made for banking to keep work moving. This means, he says, setting up tooling in rotation and scheduling work so men at different production stations do not encounter any radical work-habit changes.

D. L. Buttrey, general manager of manufacturing, points out that processing many girders —in several lengths and depths—provided an excellent chance to study and set up a production pattern that can be used over and over again in the future.

The production-line sequence of operations and the use of two fixtures provides an estimated 25 to 30 per cent labor savings. Mahon's production sequence starts with the splicing of flange and web plates in the splicing fixture (after cleaning), transporting the steel in order of assembly by crane to the long assembly fixture, fitting, tackwelding; shifting again by crane to support beams for automatic welding, layout, fitting and semi- automatic welding stiffeners on both sides of the girder, trimming and preparing the girder for painting and field erection.

The huge universal assembly fixture, one of the key features of the operations, is adaptable for any length steel member (limited only by shipping lengths). It can handle web plates 3 to 6 feet wide (depth) with flanges of various thicknesses, and conditions of camber. It includes vertical uprights and adjustable stools or jacks to position (center) a horizontal web plate in relation to two vertical flanges. Vertical risers of the fixture also are adjustable to both width and camber.

The universal splicing fixture employed for setting up top and bottom flanges can be used to splice plates of various widths — up to 18 inches wide and over 120 feet long. It can be rolled completely over, while holding the work, so a weld can be made on one side, and further welding on the other. Run-off tabs used in welding the flanges are of the same metal as that being welded and are similarly prepared. When burned off, they serve as a quality control measure for checking the welds in the main section.

Some of the work on the steel for the bridges involves web plates of 4 feet 5 inches, 4 feet 10 inches and 3 feet 10 inches in depth. The flange plates run from 9/16 to 2 inches in thickness, from 12 to 18 inches wide. The welding is done in multiple passes on the flange and single passes on the web, with the rate, or speed of welding adjusted for the size of bead required.

Typical is the splicing of a 4-foot, 10 inch, ⅜ inch thick web plate. Mechanized submerged arc welding is employed at over 500 amperes at around 35 volts. The plates are fitted from 0 to 1/32-inch gap, and the welds made at a rate of 20 inches per minute—providing a ¼-inch depth of penetration. This penetration is overlapped by the second weld which is made on the other side when the work is turned over. Butt welding of the flange plates varies—depending on the thickness of the mating pieces.

In welding the two flange plates to a web to make up a girder assembly, continuous fillet welds are involved. In this operation, two automatic, submerged arc-welding heads attached to a common track are used. They travel at the rate of 25 ipm. Welding is done at 550 amperes, 30 volts; one pass is used on each joint. Each weld is a 5/16-inch fillet. Filler wire is mild steel.

continued on next page

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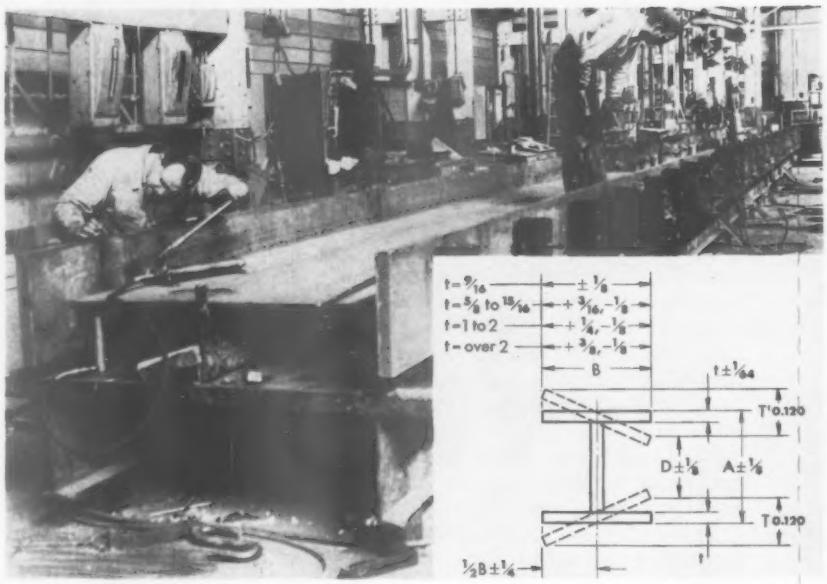


GIRDER ASSEMBLY FIXTURE is used to position web and two flanges for tack welding. Jacks are used to adjust web for camber and centering. Inset shows allowable tolerances on a typical built-up girder: 5-feet deep with 12-inch flange width. "T" represents flange thickness.

Both heads weld along the same flange—one starting from one end of the girder, the other somewhere along its length, so the cycle of each is about the same.

When the first weld is completed, the nozzle of each welding head is reversed 180 degrees so the direction of travel is reversed for the second flange. When both fillets of the girder are welded, the work is turned over by crane to weld the second side, and the same procedure is followed.

The submerged arc welding gun also is used for fillet welding both sides of the stiffeners incorporated in each girder. This operation consists of slagging the tack welds made in the fitting operation, positioning the gun, starting the flux flow and wire feed, then guiding the gun along the web and base of each stiffener.

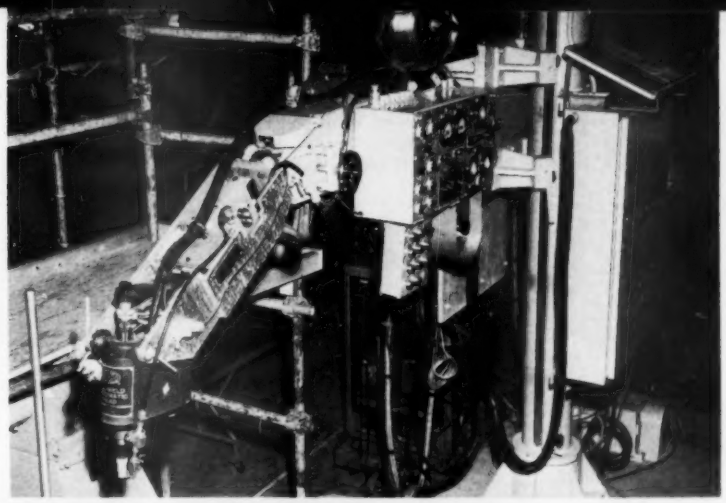
Operations involved in splicing the plates indicate the detailed planning that went into the Mahon production like operations.

The work starts here with positioning with cranes, matching web and flange plates on the splicing fixture. The flange plates are aligned—bolting only those hold-down bars (with shims and C-clamps) required to maintain alignment. The run-off bars then are tacked firmly to the ends of the joints. While the welder is welding the flange seams, the fitter fits and tacks welds the web plates positioning a copper back-up bar under the joints.

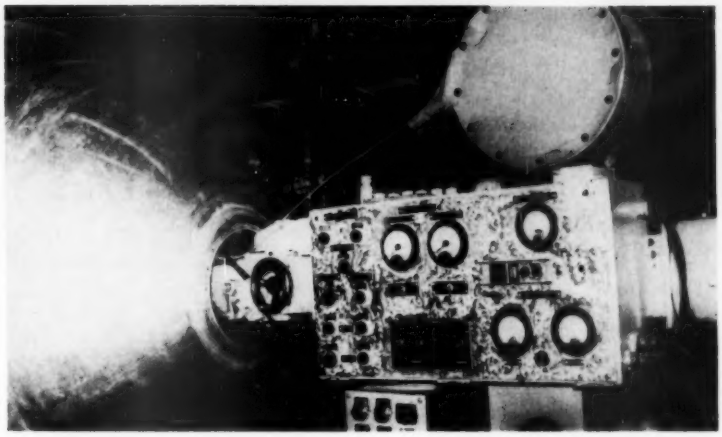
When the operator finishes using the gun on the flanges, he moves to the web. He welds the web joint with one pass. While he is doing that, the fitter grinds the flange welds just completed. The crane is called, and the units are turned 180 degrees on the assembly and turn-over fixtures. The operator then welds all flange joints on the second side.

In the meantime, the fitter moves to the flanges being welded, unbolts all clamps, cuts off run-off tabs with a torch. The operator then moves from the flanges to the web, while the fitter prepares the flanges for the next move. In the next operation the crane swings the web plate first into the huge girder assembly fixture, following up with the two flanges for tack welding prior to the shift to the automatic welders. • •

this universal welding positioner and manipulator is producing complicated airframe assemblies automatically. Its big feature is its ability to . . .



. . . weld spheres from the inside through ports. This permits the use of rigid chill bar tooling on the outside for better clamping and weld geometry control.



Automatic Welds Spheres From The Inside

IN BRIEF: It is now possible to weld spheres (and cubes) in thickness up to ½-inch automatically from the inside.

A UNIVERSAL WELDING POSITIONER and manipulator as modern as "moonshoot" has been developed by Airline Welding and Engineering, Hawthorne, Cal., for the Lockheed Aircraft Co.

The new tooling is producing quantities of complicated airframe structures automatically, but can be quickly set to do one-of-a-kind welding operations too. It is designed to precision weld assemblies (to .010″ tolerances) in any metal .005″ to .5″ thick.

Feature of the machine, designed to align and coordinate several weld positioning devices, is its ability to weld spheres from the inside through ports. This was formerly impractical or impossible by either manual or mechanical methods. In addition, easily applied and removed chill bar tooling can be used. This holds tolerances and controls weld geometry.

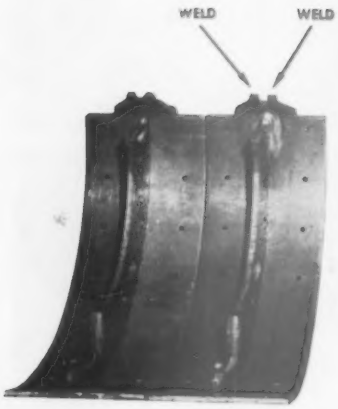
The machine is 288″ long and 50″ wide. Its main components are: a precision machined tubular base and ways; a 2,500 lb. capacity precision weld positioner and mounting plate attachments; a heavy duty ram manipulator; a heavy duty adjustable tailstock; a turning roll assembly; a welding head with a knee action manipulator; and a 500 amp AC balanced wave welder.

The AC/DC inert gas welding machine is push-button controlled from a central station, or pre-set relay chains and timing devices.

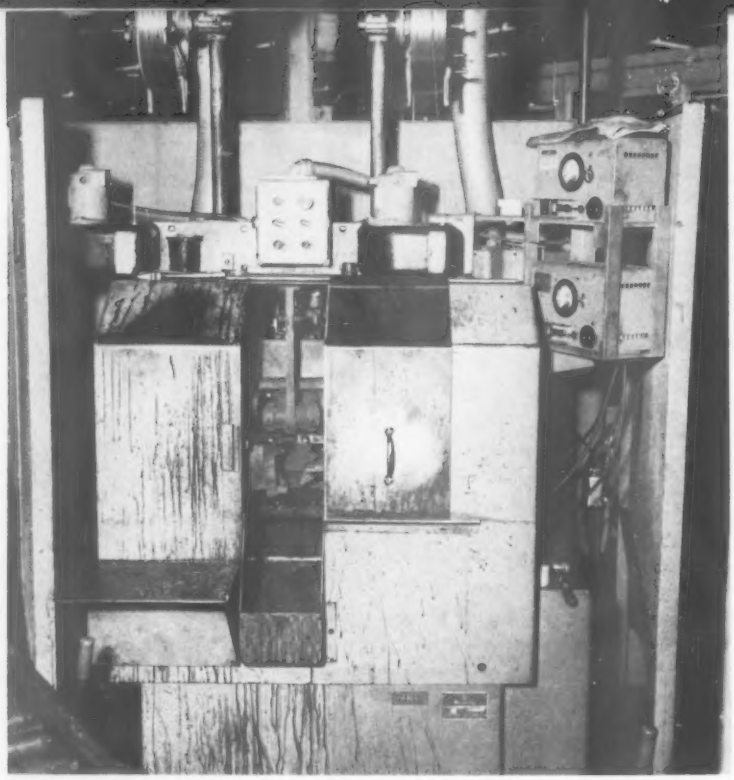
The knee action welding head arm mounted on the end of the manipulator ram can swing down almost vertically from a horizontal position, and move laterally on slides. A motorized pivot holds the welding head at the end of the arm. The torch can be pointed straight out or moved downward as much as 90 degrees.

A typical inside welding application at Lockheed is the joining of two 54-inch diameter, 5/32-inch wall aluminum hemispheres. The base hemisphere is clamped to the headstock and

continued on page 65



THE PRODUCT: Heavy truck brake shoes need two one-inch long ⅛-inch fillets to reinforce stressed anchor end.



THE PROCESS: Automatic consumable electrode welding set-up with a pair of torches replaces manual welding, improves weld quality and boosts production from 70 units an hour to 225.

Automatic Consumable Electrode Welding Boosts Brake Shoe Production 220%

IN BRIEF: You don't need miles of long, heavy welds to make automatic arc welding profitable. Light, short welds can be made economically—if you have enough of them.

WAGNER ELECTRIC CORPORATION, St. Louis, Missouri, was making one-inch long ⅛-inch fillets to reinforce heavy truck brake shoes. But, they were not being made fast enough in these high production items.

The product: These brake shoes are made by staking together two steel stampings. One is a .251-inch thick semi-circular web. The other is a formed .209-inch thick table (we'll call it a flange from now on) to which brake lining is later fastened. Two welds are made to reinforce the highly stressed anchor end of the shoes.

The old way: Welds had been made manually with a ⅛-inch diameter low hydrogen electrode (E6016) at 130 amps AC. This had two big drawbacks:

Manual welding was slow. The operator could only turn out one unit every 50 seconds—about 72 an hour. He had to pick up a staked assembly, clamp it in a swivel-type fixture and make two welds, one at a time. Then, he removed spatter and slag.

Weld quality was not consistent. Sometimes welds were porous. Other times distortion was a problem.

The new way: An automatic consumable electrode inert gas shielded setup is used. A pair of torches make both welds simultaneously. Production? It soared 220 percent—from 70 an hour to about 225.

The operator has a snap. He simply picks up a staked assembly and puts it in the welding fixture. This makes a contact with two limit switches. These start the welding cycle.

The operator picks up another assembly while welds are being made. The machine automatically kicks out completed units and is reloaded.

Current is furnished by two AC welders with high frequency arc starting. Welding is done at 300 amps. Voltage is about 80 when arc is started; it's about 25 during welding.

The 1/16-inch diameter welding wire is fed into the weld at about 50 ipm. Argon shielding gas used flows at 25 cfh. • •

Lincoln

WELDYNAMICS

NEWS ABOUT ARC WELDING AT WORK CUTTING COSTS

CLARK CUTS DOWNTIME, REDUCES MATERIAL COSTS 25%

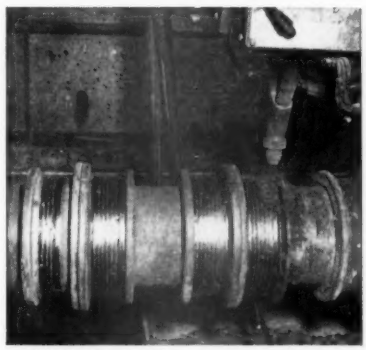
The Clark Machine and Welding Company, Inc., of Baltimore, Maryland, has a department which specializes in rebuilding industrial and construction equipment. They've grown in 25 years from a 4-man shop to the largest maintenance shop in Maryland—employing about 75 people. During that time they've tried just about every automatic hardsurfacing wire and flux available, and have had troubles ranging from high material costs to excessive downtime in the shop.

Rebuilding tractor rollers in the Clark shop. The fixture was designed and fabricated by Clark.

A. L. Ballard, Clark's welding foreman, "We've eliminated many production problems, cut costs and improved the quality of our work."

Work stoppages were caused when some welding wire would jam in the feed rolls of the automatic welder or the wire would stick. This, of course, not only caused the machine to be stopped, but affected the quality of the deposit as well.

Other granular fluxes with alloy wire were tried. Performance was better, but the alloy wire proved too expensive, according to Phillip Killen, Vice President and General Manager of the firm.



Al Ballard, the company's automatic welding foreman, has found that Lincoln agglomerated fluxes give him the most reliable performance. The fluxes not only cost 25% less than the most similar competing product, but they contain the alloying elements making it possible to use less expensive mild steel wire.

Mr. Killen states that the use of agglomerated fluxes and Lincoln automatic welding equipment have given his shop a definite advantage with consistently top quality work at a substantial saving.

HARDSURFACING INFORMATION MADE AVAILABLE

A series of How-to-do-it bulletins on Automatic Submerged Arc hardsurfacing are being published by The Lincoln Electric Company.

A basic bulletin, number 3200.1 on Automatic Submerged Arc hardsurfacing starts the series.

Specific information on hardsurfacing and rebuilding is presently available on the following items: tractor rollers, tractor idlers, mine car wheels, scraper blades, steel mill rolls, crusher rolls (with automatic), crusher rolls (with semi-automatic), Raymond bowl rolls, Raymond bowl rings, tractor treads and cement mill equipment.

Copies of these bulletins may be obtained by writing on company letterhead to:

The LINCOLN ELECTRIC CO.
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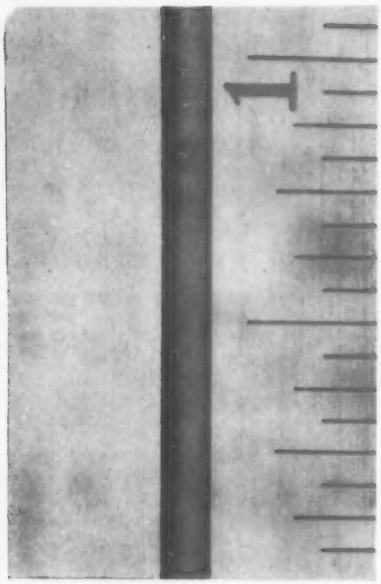
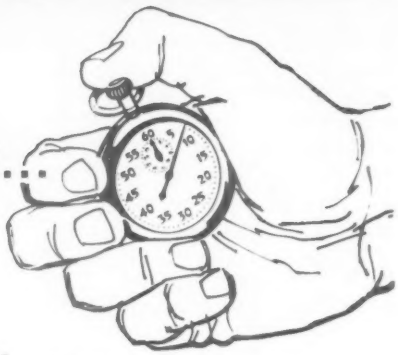


Measure the build-up height...

Clock the deposition rate...



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Literature available

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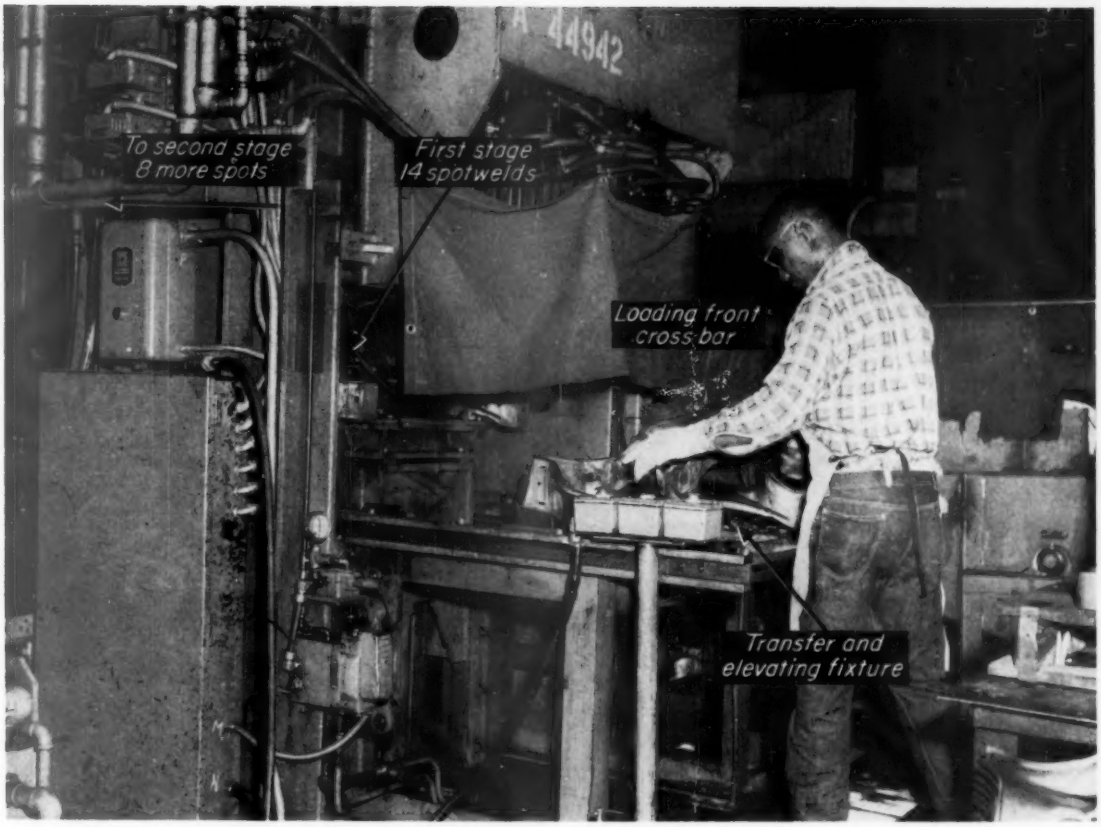


Two-Stage Multispot Welder Makes 260 Auto Frame Subassemblies An Hour

IN BRIEF: Automatic spot welding helps A. O. Smith Corp. keep up with the high-production-at-low-cost demands of the automotive industry

THE 210 WELDED automobile frames turned out hourly at A. O. Smith Corporation's Granite City, Illinois, plant make up 30 percent of all frames used by Chevrolet. (In fact, Chevrolet is the plant's only customer).

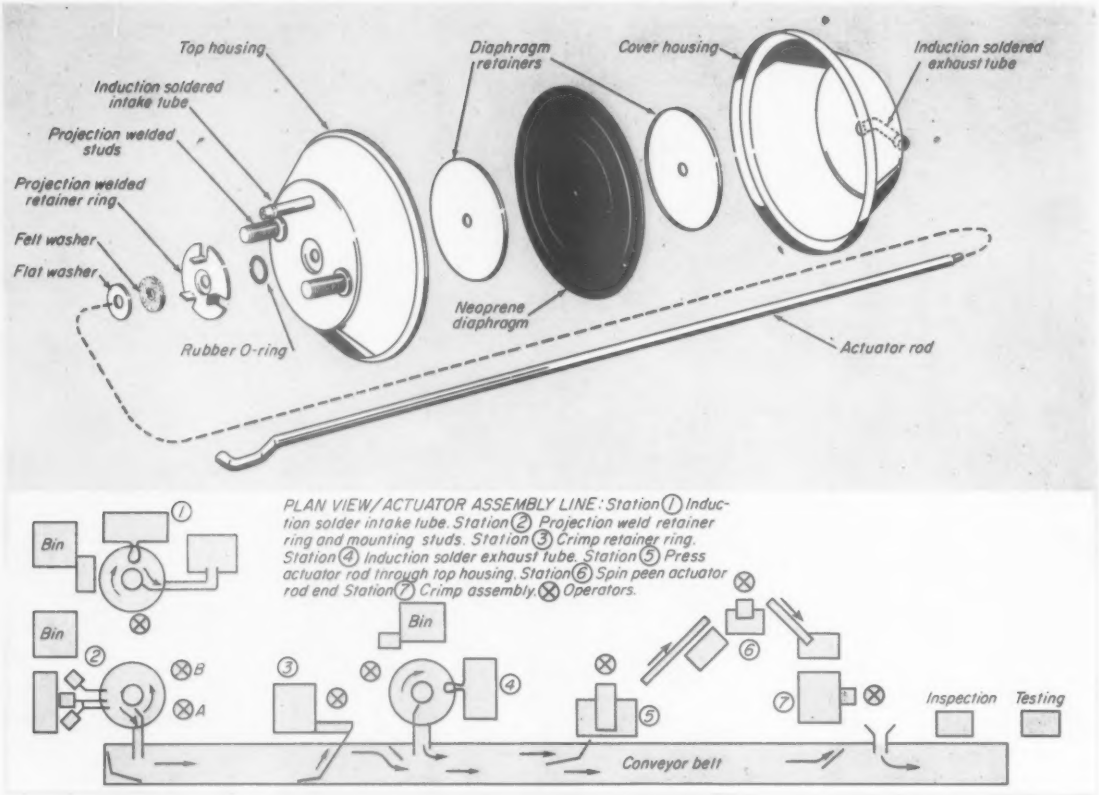
Helping maintain this high production rate is a special, multi-spot welding machine which welds a cover to the frame's front cross bar. This machine turns out 260 of these subassemblies an hour.

The subassembly is of mild steel. Eleven spot welds join the flanges on the front and rear of each part. Because the welds are so close together, the engineers positioned the hydraulically-operated welding guns to make every other weld. This meant a follow-up. Therefore the welder is a 2-stager. The first stage makes 14 welds, and the second stage adds the other 8.

Here's how it's done: The parts are hand-loaded on a conveyor transfer machine. It carries them to the first welding stage. A table raises the parts from the conveyor to a height suitable for welding and also pins the cover tightly to the front crossbar against a spring-loaded positive stop. Two 7-welding-gun banks swing into position over the front flange and another pair swings over the rear flange. Each 7-gun bank has two 150 KVA transformers. The 4 transformers are all fired together through 4 successive, complete welding sequences. Four guns are coupled to each transformer with flexible shunts. Only the gun that touches the part fires. The contacting sequence of the 4 guns is controlled by 4 hydraulic valves. They are controlled by the sequence weld timer.

The welding progresses from the center of the

continued on page 60


Top housing
Induction soldered intake tube
Projection welded studs
Projection welded retainer ring
Felt washer
Flat washer
Rubber O-ring
Diaphragm retainers
Neoprene diaphragm
Cover housing
Induction soldered exhaust tube
Actuator rod
PLAN VIEW/ACTUATOR ASSEMBLY LINE: Station ① Induction solder intake tube. Station ② Projection weld retainer ring and mounting studs. Station ③ Crimp retainer ring. Station ④ Induction solder exhaust tube. Station ⑤ Press actuator rod through top housing. Station ⑥ Spin peen actuator rod end. Station ⑦ Crimp assembly. ⊗ Operators.
Bin
Bin
Bin
B
A
Conveyor belt
Inspection
Testing

Automatic Fixturing Is The Key To Precision Welding And Soldering

IN BRIEF: Engineered assembly line with conveyor and automatic fixturing for induction soldering and projection welding makes possible top quality, high volume production

ON A '59 CHRYSLER-BUILT CAR you just have to touch a button to work fresh air, defroster, heater and air-conditioner vents. Soldered-and-welded vacuum actuators do the work. They're precision-made on a production scale at Hamlin Metal Products, Division of McNeil Machine and Engineering Company in Akron, Ohio.

Eugene Mueller, Hamlin's chief engineer knew that on ordinary production facilities he could not make the actuators cheap enough to get the contract.

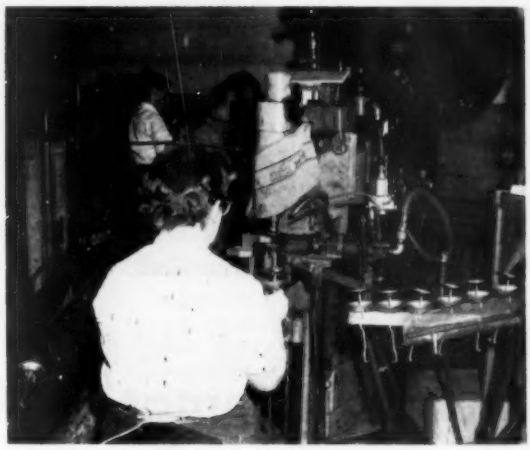
A lot of welding and soldering goes into this pint-sized actuator. Induction soldering and projection welding were Mueller's ways to do it in high volume. To use these methods of joining efficiently, Mueller designed and used precision fixturing, semi-automatic equipment and conveyor belts.

"Hamlin fabricates most of the parts that make up the actuator," Mueller said. The top housing, cover housing, retainer ring and diaphram retainer are stamped automatically on progressive dies. The brass exhaust and intake tubes are made on an automatic machine he designed. Hamlin buys the balance of the parts: neoprene diaphragm, neoprene O-ring, and felt washer.

The vacuum actuator assembly line (see plan view above) works like this:

Station 1: Mueller told us that this 12-position index welding table had many bugs before it was perfected. When you see it, induction soldering of a brass intake tube to top housing looks easy. All the operator does is load the top housing to the table starting at position 1. At position 2, an operator inserts and press fits a

LEFT: Operator (right rear) starts actuator assembly. Part then moves to projection welding and then to operator (front) who crimps retainer. **RIGHT:** Operator induction solders tube to cover.



LEFT: Air-press operator pushes rod through housing. **RIGHT:** Operator (front) spins and peens actuator rod end. The part then moves to press operator (rear) for final assembly.

brass tube with a mechanical fork-type lever arm. Once the table starts, it keeps turning automatically unless stopped. The operator keeps on loading housings and tubes.

From positions 2 to 5 nothing happens to the part. At position 6 a limit switch triggers a pressure gun that squirts a combination solder and flux paste on the soldered joint. As the part moves into position 8 a copper induction loop heats and solders the brass tube. The current heats the tube 50° to 100°F above the melting point of the solder. In positions 9 and 10 an air blast cools the soldered joint. At position 11 a jet of water and air cools still more. At position 12 the cover ejects onto a conveyor, which dumps it into a bin.

Hamlin uses the "Hamltainer," their own linefeeder, at each station of the assembly line. The linefeeders are power driven. They store, tilt and feed parts to where they are needed. The linefeeders hold a day's supply of parts.

Station 2: Follows soldering of a brass tube to the top housing. Two operators projection weld two mounting studs and a felt retainer ring to the top housing. The work is done on a 6-position index table. Operator A inserts two studs and retainer ring into die. At position 2, operator B places rubber O-ring onto a retainer ring and top housing on the same die. Once the table is started, it automatically rotates, and each operator continues positioning parts.

Welding starts at position 4. A twin copper electrode projection welds the two studs to the top housing. At position 5 a single copper electrode projection welds the retainer ring. As the part moves into position 6, the top housing is ejected with an air blast onto a belt conveyor.

At this point, as we were walking along the assembly line, Mr. Mueller said that at this operation the part is fed continuously to the other operations.

continued on page 60

Combustion Engineering switched welding processes because . .

FAST, SEMI-AUTOMATIC WELDING permits deposition of about 10½ lb. of metal per hour on this fan casing reinforcing plate joint. Wire, flux and controls are located on the operator's adjustable platform.

INVERTED WELDING POSITIONER and adjustable height welding platform enable the operator to make a corner weld in the flat position. Wrapper plate is ¾-inch thick, side plates are 1-inch thick.

Semi-Automatic Welding of Heavy Fan Casings Is 25 Percent Faster

by **CARL BURROW**, *plant engineer, Combustion Engineering Co., St. Louis, Mo.*

IN BRIEF: Continuously-fed wire coated magnetically with flux and shielded with CO_2 makes weld deposits four times faster than manual welding.

WE SWITCHED to semi-automatic welding for 90 percent of the welding on heavy fan casings for power plant blowers at Combustion Engineering Company, St. Louis, and slashed production time on these huge pieces by 25 percent—from 24 to 18 hours.

Fan casings, which provide the blast for the combustion of powdered coal in high-pressure power-plant boilers, are made from ½- to 1½-inch thick mild steel plate.

Casings are assembled, tack-welded, and then placed on a welding positioner. The welding operator and the semi-automatic equipment are located on an adjustable platform which is raised or lowered to position the operator at the proper welding height. This enables the operator to make all welds in the flat position.

The welding equipment we used on this job is Linde Company's Unionarc process. This steel-welding process uses a continuously-fed wire electrode that is magnetically coated with flux and shielded by carbon dioxide gas. It can be used in all welding positions and will weld up to four times faster than covered-electrode welding.

We use 3/32-inch diameter welding wire (Oxweld No. 43) and set the welding machine at 400 amps, DC, reverse polarity. Two passes are usually required to make each of the outside corner welds which join the circumferential plates to the supporting plates.

Here are the savings this process has created for us: operating time has been cut 25 percent; deposited metal per pound of wire has been increased 25 percent; and post-weld cleaning time has been markedly reduced because there is little spattering. • •

Plant, Research Laboratory and World Headquarters

HISTORY OF "EUTECTIC LOW TEMPERATURE WELDING ALLOYS"®

Surface alloying at low heat was first discovered by "Eutectic" in 1904 — used today in over 100,000 plants. "Eutectic" is the originator and sole manufacturer of "Eutectic Low Temperature Welding Alloys" for bonding metals at low heat, minimizing distortion, warping and stress.

EUTECTIC Welding News

PUBLISHED BY EUTECTIC WELDING ALLOYS CORPORATION, 40-40 172 STREET, FLUSHING 58, NEW YORK, N.

5 MONTH "DOWN TIME" AVOIDED... COSTS CUT 66%

This pulverizer intermediate ring, used by a cement company, cracked in operation. Replacement posed a difficult and time consuming problem. Obtaining a new ring would have kept the pulverizer out of operation for at least five months.

In spite of the fact that the ring rotates at high speeds and is subject to the shock of impact from heavy steel balls bouncing around and abrasive wear while grinding shale, it was decided to try welding the damaged part.

One of the special problems in connection with repair was that the ring was made of alloy steel and cutting out the cracks became a special job in itself. A cutting torch did not remove metal quickly enough and the high heat involved had a tendency to cause additional cracks and fissures. Grinding wheels were considered, but this would have taken a great deal of time and the tough alloy steel raised havoc with these grinding wheels.

A special oxygenless cutting electrode ChamferTrode was used to gouge out the cracks. This method resulted in extremely rapid removal of the unwanted metal in the area to be welded.

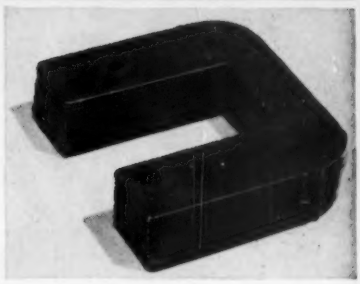
EutecTrode 680 AC-DC was used for the filling operation. This is an extra-high strength, Low Amp electrode, used where embrittlement must be avoided. It provides an ideal hard overlay cushion. EutecTrode 680 AC-DC permits quality welding on pressure vessels, dies, tools and has also seen wide use in rebuilding chemical agitator blades and shafts.

EutecTrode 680 AC-DC also has a "Frigid-Arc" coating — allows smooth, porosity-free dense deposits without spatter, and with exceptional freedom from cracking. Welds are easily deposited at the highest possible speed with least amount of base metal heat, using lowest possible amperage. The ultimate tensile strength, up to 120,000 psi.

Once the pulverizer ring was prepared and readied, weld deposits were completed, then ground flush with the rest of the ring. The mill was then put back into continuous operation with the repaired ring and has operated perfectly in spite of the heavy continuous punishment this part receives.

Materials for the repair were less than 1/5 the replacement cost, and the mill was back in full production in less than three days.

EUTEC-SILWELD 1618 PROVIDES SILVER LINING



A substantial saving was made by a transformer fabricator in laminating coils with paste-on form, silver content alloy, Eutec-Silweld 1618. The paste form eliminated unnecessary handling and waste in replacement of solder strip, and proved considerably faster in application.

Production of Eutec-Silweld 1618 in paste form partially explained its lower heat input. The minute silver particles suspended in flux melt and flow faster than solid silver. It joins at heat input as much as 150°F. less than required for conventional silver brazing material, and the lowest heat range possible for silver content alloys.

In this transformer application, the unusually low bonding temperature with Eutec-Silweld 1618 not only foreshortened induction heat cycle time, but virtually eliminated rejects caused by conventional high heat welding materials.

EutecTrode 680 AC-DC, available in 3/32", 1/8", 5/32", & 3/16" dia. Lt. Blue Tip. Standard weight shipments. • **Eutec-Silweld 1618,** packaged in 8 oz., 1 & 2 lb. jars.

VISIT US AT THE 11TH WESTERN METAL EXPOSITION AT THE PAN-PACIFIC AUDITORIUM, LOS ANGELES, MARCH 16-20, BOOTH 601.

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VISIT US AT THE AMERICAN WELDING SOCIETY SHOW, INTERNATIONAL AMPHITHEATRE, CHICAGO, ILLINOIS, APRIL 7-9, BOOTH 500.

EUTECTIC 'LOW TEMPERATURE WELDING ALLOYS'® FORMULATED FOR 'LOW HEAT INPUT' BONDING OF ALL METALS INCREASE SAVINGS BY SALVAGE AND REPAIR, SOLVE PRODUCTION PROBLEMS

PRO GETS NEW LOOK AT WELDS WITH X-RAY

Learns to use portable Baltospot in a matter of hours

SO COULD YOU! There's no mystery about taking your own weld X-rays. You or your men can learn to make good radiographs in less than a day—with Baltospot portable X-ray equipment.

There are only three simple steps:

1—Measure thickness of part and refer to chart
2—Make exposure
3—Develop film according to chart

Nothing could be simpler. It's a terrific cost-cutter, too (77 percent savings on inspection costs were recently reported by a prominent tank fabricator). And a real incentive for maintaining good weld quality—keeps the occasional faulty weld from becoming a costly repetitive fault.

Your Westinghouse X-ray representative has the whole cost-saving story on Baltospot portable X-ray equipment. Or write: Westinghouse X-ray Department, 2519 Wilkens Avenue, Baltimore 3, Maryland. J-08377

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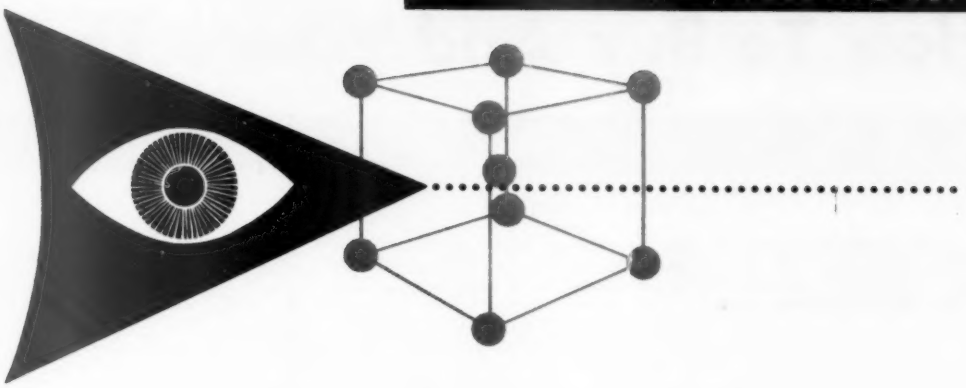

Nondestructive Testing Of Welded Fabrications

In 1959 you'll be able to get nondestructive testing and inspection equipment and accessories to check just about any welding job you do. The reason? A wide variety of new and improved equipment is now available. This was developed to meet two specific needs:

First, more and more manufacturers and fabricators are inspecting and testing welds — even when it is not required by codes and/or specifications. And, they're saving money doing so.

Secondly, new applications for metals (and new metals) are making greater demands on the joints that connect them. Take rockets and missiles, for example. You can't think of launching them until you know you have quality welds.

To help you we contacted the leading manufacturers of nondestructive testing equipment and had . . .

These experts tell you how to buy and use nondestructive testing equipment . . .

WILLIAM BLUCKE, *application engineering manager*
Acoustica Associates, Inc.

DAN M. FRETWELLER
Aetna Engineering Company

N. F. RINCKER, *marketing manager, Ansco*

ROBERT L. SHAFER, *vice president*
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Balteau Electric Corp.

JOHN E. BOBBIN, *sales manager*
Branson Instruments, Inc.

JAMES A. COMMINS, *manager, radiographic instrument sales, Curtiss-Wright Corp., Princeton Div.*

W. F. SMITH, *manager, ultrasonic sales, Curtiss-Wright Corp., Princeton Division*

A. C. HUBBARD, *X-ray products manager E. I. du Pont de Nemours & Company, Inc.*

WILLIAM D. KIEHLE, *X-ray div. Eastman Kodak Company*

DOAN RYLE,
Fedrex, U.S.

EDWARD W. PHILLEO, *manager, marketing, industrial*
General Electric Co., X-ray Dept.

DONALD D. STORING, *manager, industrial sales division*
Gevaert Company of America, Inc.

E. ALFRED BURRILL, *vice president-sales manager*
High Voltage Engineering Corp.

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Nuclear Advisors, Inc.

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A Division of the Budd Co.

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Peterson Machine Tool, Inc., Sonoflux Division

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St. John X-Ray Laboratory

R. Y. NEILEY, *assistant sales manager*
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Triplett & Barton, Inc.

C. F. DEVINE
Turco Products, Inc.

R. E. KLEINT, *vice president*
Ultrasonic Testing & Research Laboratory

W. R. HAMPE, *manager, industrial product section Westinghouse Electric Corp., sales department, X-ray Division*

32 experts tell you . . .

How To Buy And Where To Use

	X-RAY	GAMMA	FILM
Principal Applications	Used mainly to inspect the interior soundness of all metals. Detects internal defects in welds: gas porosity, slag inclusions, incomplete penetration, cracks, icicles and burn-through; also used on castings, forgings, and worked and formed metal parts.		Used in conjunction with X-ray and gamma ray inspection.
Advantages	Shows size and nature of hidden flaws or discontinuities in different thicknesses of metallic and nonmetallic materials; gives a permanent, graphic record of defects. Has established standards, is easy to interpret and is accepted by the government and private agencies. X-ray energy can be adjusted for use on a variety of materials and material thicknesses. Radiation source can be turned off when not in use. Generally gives greater sensitivity than gamma techniques. Fluoroscopy techniques are usually available. Better than gamma for use on extremely thin sections.	Shows size and nature of hidden flaws or discontinuities in different thicknesses of metallic and nonmetallic materials; gives a permanent, graphic record of defects. Has established standards, is easy to interpret and is accepted by the government and private agencies. Needs no electrical power sources nor oil- or water-cooling. Process is more portable. Smaller source holder permits use on intricate or complex jobs. It can be used for panoramic techniques that might not be possibe with X-ray. Initial cost is relatively low. Shows up defects on a wider range of metal thicknesses on the same radiograph.	Offers an opportunity to study radiographs; gives a permanent, graphic record of the examination. A variety of films available gives flexibility in getting various combinations of radiographic sensitivities and exposure times.
Limitations	A power source and oil-or water-cooling is needed. Size and weight are generally larger than gamma equipment. More difficult to position on intricate or complex jobs. Does not work as well as gamma on panoramic exposures. Initial cost is relatively high. Shows up defects on a narrower range of metal thickness on the same radiograph. Trained technicians are needed.	Energy cannot be adjusted; isotope must be chosen to meet the sensitivity requirements of a particular type and thickness of material. Radiation source cannot be turned off; a government license is needed for possession and use of isotopes. Sensitivity is not as great as with X-ray. Fluoroscopy techniques are normally not available. Not as good as X-ray for extremely thin sections. Trained technicians are needed.	Processing is required; there is no split-second examination. Films must be interpreted.

IN BUYING EQUIPMENT for nondestructive testing of welds, remember that each type has its own advantages and disadvantages. Naturally, you must select the one you need with an eye on the job you expect it to do. But, keep in mind that while a single type may do the job, you may have to change the testing method when and if you change the size and shape of the part or the material from which it is made.

Price is an important factor, of course, but it is not the last word. Chances are you will decide on a particular type of nondestructive testing equipment for a particular application—and you'll have to pay the price. Of course, where there is a choice between two methods, you'll have to weigh carefully the advantages and limitations of both. Remember that most methods are versatile: They can be used in place of another nondestructive testing method and for a variety of other inspection jobs other than checking weld quality.

Here's what you should know about each:

RADIOGRAPHY is basically a method of taking pictures. Instead of using visible light rays, the radiographer uses invisible short wave-length rays developed by

Nondestructive Testing Equipment

MAGNETIC PARTICLE	ULTRASONIC	PENETRANT
Used to detect cracks that result from fatigue, thermal stresses, gas pockets, lack of fusion and slag inclusions in ferromagnetic materials.	Used on weldments, castings and forgings, on plate and sheet metal, rods, bars and tubes. Two forms available: One (resonance) is used for gaging thickness and detecting thinning due to corrosion. The other (pulse-type) finds internal defects, including cracks, poor bonding, inclusions and laminations. Used to inspect long distances in metal and on large pieces.	Used to locate surface cracks, porosity and leaks in nonporous solids: metals, ceramics, glass and most plastics. Used in production dip tanks or with portable kits.
Positive method for finding crack-like defects at or close to the surface. Method is flexible and economical. Portable equipment is available. It can be set-up for continuous production-line inspection.	Speedy process gives instantaneous easy-to-read information on size, locations, orientation and degree of flaw. It allows inspection from one surface and gives clear indication of sub-surface defects over a range of depths up to 25-feet. Equipment is mobile, light and relatively inexpensive. Accuracy is not affected by radiation, temperature or pressure. In measuring thickness, instantaneous readings are obtained in thousandths of an inch with an accuracy of 2 percent of thickness. Process lends itself to automation.	Detects extremely minute cracks and leaks. Dye penetrant appears as a deep red on white background; fluorescent penetrant glows brilliantly under black (ultraviolet) light. Simple, accurate, fast; low installation and per-item cost.
Limited to ferromagnetic materials. No indications apparent for cracks parallel to the magnetic field so magnetism for two directions is needed to find all discontinuities. Surfaces must be clean and dry; surface roughness decreases sensitivity. It is not suited for deep-seated small defects.	Power source is necessary and photographs must be taken for permanent records. Total immersion of parts is required with some types of equipment. It is not usable on "as cast" or "coarse grain" materials nor on small, irregularly-shaped parts. A couplant (oil, glycerine or water) must be used to provide a path for the ultrasonic waves. Technicians need training in interpreting and analyzing defects.	Not effective on subsurface defects. Surfaces must be free from oil and grease. A semi-darkened area is necessary for good inspection with the black light. Portable kits require a source of electricity.

X-ray machines, radioactive isotopes (gamma ray) and variations of these methods. These rays penetrate solid materials—metals, glass, wood, plastic, leather and ceramics—and reveal defects on a film or screen. Flaws show up on films as dark areas against a lighter background.

Four factors which affect the selection of the radiation source will be discussed under the "X-Ray" and "Gamma Ray" sections which follow. These factors include thickness and density of the material and its absorption characteristics, time available for inspection, and location of the weld.

Correctly exposed and processed radiographs should show any changes in metal thickness above the minimum sensitivity level for the particular combination of radiation source and film used. For example, where a 2-percent minimum sensitivity is specified, inspection should show up holes 0.020-inches in diameter or larger in a plate 1-inch thick. Under ideal conditions, sensitivities of 1- or even ½-percent may be obtained.

Any discontinuity larger than minimum size —whether due to lack of fusion, slag entrapment, porosity, cracking, undercutting, gouging

continued on next page

NONDESTRUCTIVE TESTING

continued from page 43

or even surface ripples on the weld bead—should be shown on the radiograph.

Since discontinuities represent less metal thickness—and therefore less absorption of the radiation beam—they will be recorded on the film as dark areas compared with the normal coloring (or density) of the supposedly sound metal areas. Discontinuities, such as icicles, weld reinforcements, misalignment and spatter, will show on the radiograph as light areas since they represent metal sections normally thicker than the average metal thickness.

X-RAY MACHINES generally consist of a control and a housing which contains a high-voltage transformer and an X-ray tube. These machines are classified according to their maximum voltage (designated as kvp or kilovolt peak) which may range from 50 kvp (50,000 volts) to 15-24 mev (15-24 million electron volts). They will handle up to 20-inches of steel or its equivalent.

The selection of the correct equipment for a particular application is determined by: the voltage range required, degree of utility, economics of the inspection and production rates expected. It is not economical to select the highest voltage apparatus to meet all inspection requirements; on the other hand, it is uneconomical to extend low-voltage equipment to thicknesses where excessive exposure time is required and inspection sensitivity is reduced.

The number of radiographs required per day should be considered in selecting the voltage range of X-ray equipment. If the number of exposures required per day and the average thickness of material is known, the proper voltage range can be selected to get the desired production inspection rate.

Another consideration is the cost per exposure. After the initial investment in X-ray equipment, the principal continuing cost of operating the apparatus is the replacement of the X-ray tube. Other factors of cost, such as films, labor, building and maintenance, are unrelated to the voltage range. Higher voltage machines, however, require larger rooms, thicker shielding and cost more to maintain.

Here's what you can expect from some of the typical X-ray machines available:

50 kvp units are used on extremely thin sections without an intensifying screen.

150 kvp machines are used on 5-inch aluminum or equivalent in light alloys and 1-inch steel or its equivalent. A lead foil intensifying screen is sometimes used. When these machines are used on 1½-inch steel or equivalent, a fluorescent (calcium tungstate) intensifying screen is used.

250 kvp units are used on 2-inch steel or equivalent (lead foil screen) or 3-inch steel (fluorescent screen).

400 kvp machines are for 3-inch steel or equivalent (lead foil screen) and 4-inch steel (fluorescent screen).

1000 kvp units are used on 5-inch steel or equivalent (lead foil screen) and 8-inch steel or equivalent (fluorescent screen).

2000 kvp equipment handles 8-inch steel or equivalent (lead foil screen).

15-24 mev (million electron volt) equipment is used on 16-inch steel or equivalent (lead foil) or 20-inch steel or equivalent (fluorescent screen).

These machines may be fixed or mobile, depending on design. For inspecting parts which can be moved easily, machines used are usually installed permanently in a room protected against radiation escape. The X-ray tube itself is often mounted on a stand or suspended from a bridge crane, permitting freedom of movement.

Portable equipment is available for examining fixed or hard-to-move objects. These units may be truck- or cart-mounted or even carried by hand. Some used in pipelines are self-propelled.

Size and weight of these units increase rapidly as the voltage increases. A portable 140 kvp unit (and accessories) sells for about $3,000 and weighs 110 pounds with carrying case. A 250 kvp stationary unit costs $12-14,000. One of the large 2-million volt machines may cost as much as $125,000.

Two other sources of high energy radiations required for X-ray inspection are available. These are the induction electron accelerator (betatron) and the linear accelerator. These sources don't use the correspondingly high voltages required for accelerating the electrons. They carry the X-ray energy level to the tens-of-millions electron volts for both deeper and sharper pictures. The betatron consists basically of a magnet and transformer to guide and accelerate electrons in a circular orbit to very high energies. Electrons of a few hundred volts acceleration per revolution are thus energized to many millions of electron volts before striking a target to produce X-rays.

Variations of X-ray inspection techniques include fluoroscopy, X-ray television systems and Xeroradiography.

Fluoroscopy differs from radiography in that the image is viewed directly on a fluorescent screen rather than from a film record. This technique offers fast, low-cost, reasonably sensitive inspection. Because you can view the part from all directions when using fluoroscopy, the overall quality level may be equal to radiography. Initial cost of the set-up may exceed that of a radiographic installation. This depends on complexity of work-handling equipment and degree of sensitivity required.

Televised X-ray inspection is a direct viewing, remote, instantaneous system. Weldments on a conveyor or positioner are X-rayed completely and viewed at the same time on a remote moni-

text continues on page 47

Circle No. 78 on Reader Service Card.→

"Handling time cut 35%—with 510 Day Pack Roll Film"

Calvin Esslinger, Section Head of X-Ray Laboratories at Kaiser Metal Products, Inc., Bristol, Pa., reports that they have eliminated all pre-exposure film handling since switching to Du Pont Type 510 Day Pack X-ray Film.

Says Mr. Esslinger, "Among other work, we make pressure vessels for guided missiles. Almost all our inspection is of welds both longitudinal and circumferential. Before Du Pont offered 510 Film in its own opaque paper sleeve, we often had to make seven or eight separate exposures in order to cover one 360° weld, and the film had to be placed in specially purchased holders.

"Now we don't have to load film in a darkroom. We simply cut the correct length and tape the ends. We save time, we avoid the risk of scratching the film during pre-exposure handling, and we need to make fewer exposures per weld."

Mr. Esslinger has found that 510 Film has the very fine grain and high contrast necessary to meet the highest government standards of inspection. "Obviously," he says, "only the best available film can be used. We feel, without qualifications, that Du Pont 510 meets these rigid requirements."

For more information on Du Pont Day Pack Roll Film, and other fine industrial x-ray products, send the coupon below. In Canada, write Du Pont of Canada Limited, Toronto.

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COMPANY	X-RAY		GAMMA		FILM	MAGNETIC PARTICLE	ULTRA-SONIC	PENETRANT
	Portable	Stationary	Portable	Stationary				
ACOUSTICA ASSOCIATES, INC. 26 Windsor Ave., Mineloa, New York							X	
AETNA ENGINEERING COMPANY 14106 Aetna St., Van Nuys, Calif.	X						X	
ANSCO, A DIVISION OF GENERAL ANILINE AND FILM CORP. Charles Street, Binghamton, N.Y.					X			
AUTOMATION INSTRUMENTS, INC. 401 East Green St., Pasadena, Calif.							X	
BALTEAU ELECTRIC CORP. New and Meadow Sts., Stamford, Conn.	X	X						
BRANSON INSTRUMENTS, INC. 37 Brown House Rd., Stamford, Conn.							X	
CURTISS-WRIGHT CORP., PRINCETON DIV. P.O. Box 110, Princeton, New Jersey	X		X	X			X	
E. I. du PONT de NEMOURS & COMPANY, INC. Nemours 2432-A, Wilmington 98, Dela.					X			
EASTMAN KODAK COMPANY 343 State St., Rochester 4, New York					X			
FEDREX, U.S. P.O. Box 225, Roselle, Illinois	X							
GENERAL ELECTRIC CO., X-RAY DEPT. 4855 West Electric Ave., Milwaukee, Wisc.	X	X						
GEVAERT COMPANY OF AMERICA, INC. 321 West 54th St., New York 19, N.Y.					X			
HIGH VOLTAGE ENGINEERING CORP. S. Bedford St., Burlington, Mass.	X	X						
KELVIN & HUGHES (CANADA) LIMITED 401 McGill St., Montreal, Quebec, Canada							X	
MAGNAFLUX CORPORATION 7348 W. Lawrence Ave., Chicago 31, Ill.						X	X	X
MET-L-CHEK COMPANY 11919 S. Western Ave., Los Angeles 47, Calif.								X
MITCHELL RADIATION PRODUCTS CORP. E. Washington St., Norristown, Penna.	X	X	X	X		X		
NARDA ULTRASONICS CORP. 625 Main Street, Westbury, L.I., N.Y.							X	
NUCLEAR SYSTEMS, A DIVISION OF THE BUDD CO. 2950 Roberts Ave., Philadelphia 32, Penna.			X	X				
PETERSON MACHINE TOOL, INC., SONOFLUX DIVISION 6200 Merriam Drive, Merriam, Kansas						X		
PHILIPS ELECTRONICS, INC., INSTRUMENTS DIVISION 750 S. Fulton Ave., Mount Vernon, New York	X	X						
PICKER X-RAY CORPORATION 25 South Broadway, White Plains, N.Y.	X	X	X	X				
PIONEER INDUSTRIES, DIV. OF ALMAR-YORK CO., INC. 3455 West Vickery, Forth Worth, Texas							X	
ST. JOHN X-RAY LABORATORY Califon, New Jersey	X	X	X	X				
SPERRY PRODUCTS, INC. 2303 Shelter Rock Rd., Danbury, Connecticut							X	
TRIPLETT & BARTON, INC. P.O. Box 3128, Burbank, Calif.	X	X						
TURCO PRODUCTS, INC. 6135 So. Central Ave., Los Angeles 1, Calif.								X
ULTRASONIC TESTING & RESEARCH LABORATORY 14710 Raymer St., Van Nuys, Calif.							X	
WESTINGHOUSE ELECTRIC CORP., X-RAY DIVISION 2519 Wilkens Avenue, Baltimore 3, Md.	X	X						

NONDESTRUCTIVE TESTING

continued from page 46

tor screen. No film is used. Images viewed in normal light are said to be many times brighter than fluoroscopic images. Image size is variable from ½ to three times that of the original object.

Xeroradiography is a rapid method for dry-processing X-ray images. It will frequently disclose discontinuities that cannot be seen on film. Greater speed, an image that can be viewed in less than one minute after exposure and absence of films and darkroom are other advantages.

GAMMA RADIOGRAPHY

has two main advantages: portability and low cost. These characteristics extend the application of gamma radiography to include many items which due to their size, shape or physical location are impossible to radiograph with the usual X-ray techniques. This lower cost makes the use of gamma radiography practical for many other additional applications.

However, this does not mean that gamma radiography is preferable to X-ray for every application. In certain cases, X-ray is better than gamma. Generally, an X-ray machine is more flexible than an isotope as a radiation source since its KV (kilovoltage) and MA (milliamperage or quantity of radiation) can be varied over a certain range. In general, isotopes are better for thick sections of metal, while X-ray is better for thin.

A gamma radiography set-up consists of three things: a source holder (also called a head, shield or safe), handling or manipulating equipment and a radiation source.

Source holders can serve two purposes. First, they safely store the radioactive source which is continuously emitting gamma radiations. Secondly, some work like a camera; opening a shutter exposes source and directs radiations.

The size of the source holder depends on the strength and size of the source being used. They can be carried by hand, moved by wheeled truck or mounted on fixed stands.

Handling or manipulating equipment is simple or relatively complex, again depending on the strength of the source.

The simplest equipment available is a stick with a battery-operated electromagnet for picking the source out of the source holder and positioning it. More complex equipment has electrically- or compressed air-powered remote controls which move the source through a hollow cable to the weld being inspected.

Power sources for gamma radiography are radioactive materials whose atomic structures are not stable. As they break down, these materials give off gamma rays which are similar to X-rays. These radioactive materials occur in nature or are made artificially in atomic reactors.

Gamma rays have various wave lengths and are comparable to X-rays generated at different voltages. Since the radioactive material is decaying, the amount of energy is constantly diminishing. The period in which the amount of energy of an isotope decays to half its original value is called its half life.

The problem of choosing a source involves consideration of the type and thickness of material to be inspected, the exposure time which can be tolerated, the frequency of the exposures, cost, desired sensitivity and geometrical constraints imposed on the exposure.

There are five radioactive materials commonly used as gamma ray sources.

Radium is the principal radioactive material occuring naturally. It gives off rays having a wide range of wave lengths, has a long half life (1700 years) and a useful range in steel from one-inch to 10-inches. Disadvantages including high cost and low specific activity (resulting in large sources with the attending difficulties of poor definition) have resulted in radium's replacement by these isotopes:

Cobalt 60 is equivalent to X-rays of about 1.3 mev (million electron volts) and has a half life of 5.3 years. Its range in steel is from 1- to 6-inches. Advantages include high specific activity, low cost and wide range of applications.

Iridium 192 is equivalent to 400kv X-ray and can be used on steel up to three-inches. Its radiations are softer (of longer wave length) than those from Cobalt 60 which makes it more useful for thinner sections. Furthermore, its extremely high specific activity makes possible very small but powerful sources. Theoretically, the short half-life (75 days) is a disadvantage, but modern methods of source replacement have made Iridium 192 a very useful isotope.

Thulium 170 has attractive theoretical advantages for light alloys or very thin steel sections, but obtaining it in a sufficiently pure

continued on next page

Don't overlook these companies . . .

Many accessories, auxiliary equipment and specialized methods for nondestructive testing could not be fitted into the chart on the opposite page. Here is a listing of some typical companies that manufacture and market these products:

Eddy current testing: Magnaflux Corp.
7348 W. Lawrence Street, Chicago 31, Ill.

Film badges and service: Nuclear Advisors, Inc.
33-61 Crescent St., Long Island City 6, N.Y.

Film salvage: Handy & Harman
82 Fulton Street, New York 38, N.Y.

Mass spectrometers: Veeco Vacuum Corp.
86 Denton Ave., Hyde Park, L.I., New York

Penetrameters: Jem Penetrameter Mfg. Corp.
122 Hampshire St., Cambridge, Mass.

Radioisotopes: Tracerlab, Inc.
1601 Trapelo Road, Waltham, Mass.

Safety equipment and clothing: Bar Ray Products
209 25th Street, Brooklyn 32, N.Y.

X-ray tubes: Machlett laboratories
Springdale, Connecticut

NONDESTRUCTIVE TESTING

continued from page 47

state to obtain desired qualities is somewhat difficult. Thulium 170's half life is 129 days; it is equivalent to about 85kv X-ray.

Cesium 137 has radiation characteristics intermediate between Iridium 192 and Cobalt 60 with a long (27 years) half-life. Two disadvantages hinder its wider use: its specific activity is low, resulting in long exposure times and physically larger sources, decreasing the definition of the radiograph; secondly, Cesium 137 sources are composed of compacted Cesium chloride which means possibility of leakage with this material is much greater than with other sources. For this reason, the Atomic Energy Commission requires that Cesium sources be inspected with special equipment at least every six months, adding to the cost of using this source.

Other isotopes in various stages of evaluation are Cerium 144, Cesium 134 and Sodium 24. Cerium 144 holds promise of fulfilling the need for low energy gamma source. Cesium 134 promises greater specific activity than Cesium 137. Sodium 24 has been used where extremely powerful sources are required, but its very short half life (14 hours) prevents its use except for special applications.

Overexposure to radiations from X-ray and gamma sources can cause injury to operating personnel.

You can shield workers from this overexposure in three ways:

Keep them away from radiation sources. The intensity of radiations vary inversely as the square of the distance from the source. This means doubling the distance from the source reduces radiation intensity by four times.

Control the direction of radiation beams. Direct them away from workers or any occupied areas nearby.

Provide suitable protective barriers. Lead is the best shield, but concrete and lead-concrete or brick-concrete combinations are also used.

Radiations cannot be seen, heard, felt or smelled. This makes it doubly important to check the effectiveness of the protective measures just described. This can be done in several ways:

A film badge (lead-backed film) is worn by workers for a given time, usually a week or two. Film is then removed and developed. Resulting radiograph is compared with a set of standard films to determine extent of exposure. The developing and comparing is usually done by a monitoring firm which furnishes badges and reports extent of exposure on a contract basis.

Exposure meters and Geiger counters can also be used to check radiations.

RADIOGRAPHIC FILMS

are responsive to "soft" (low energy) radiation as well as to "hard" (high energy) radiation. Hence, they can be used with all sources of X-ray radiations: low kilovoltage (65-400kvp) and supervoltage (1-24mev) X-ray generators. Likewise, they can be used with the currently available gamma ray sources.

X-ray emulsions can be used throughout the range of specimen densities. They are used to inspect low-density materials (plastic powders), high density materials (lead) and all materials of intermediate densities (aluminum, magnesium, titanium, copper, iron, steel and zircaloy).

Film selection depends on the material being inspected and its thickness. It also hinges on the voltage range of the X-ray machine available or the strength of the gamma ray source.

In addition, the choice is governed by the relative importance of high quality radiographs or short exposure time. If high quality is needed, a slower and finer-grained film must be substituted for a faster, coarser-grained film.

These are the four basic types of film currently available.

Type I offers extra fine grain and high contrast. It is used to obtain the highest quality from high voltage X-ray equipment or for light metals like aluminum and magnesium. Recommended for any metal requiring the most critical radiography possible, it is used direct or with a lead-foil screen.

Type II offers fine grain and high contrast. It is designed for the radiography of light metals at lower voltages and for 1000 and higher kilovolt radiography of heavier steel parts. This type has a grain not quite as fine as Type I, but its higher speed makes it more widely usable. It is used direct or with lead-foil screens.

Type III gives highest available speed and high contrast when it is used with fluorescent screens. It is useful for examination of steel, brass, etc. with machines of limited kilovoltage. It gives lower contrast when used directly or with lead-foil screens. It records a large range of thicknesses in a relatively small density range.

Type IV gives highest speeds when gamma rays or high voltage X-ray are used direct or with lead-foil screens. In work with fluorescent screens, this type has about 1/10 the speed of Type III, but has a higher contrast and greater density range.

Radiographic films enclosed in conventional cardboard film holders can be carried to remote exposure sites and formed to fit the shape of the object to be inspected.

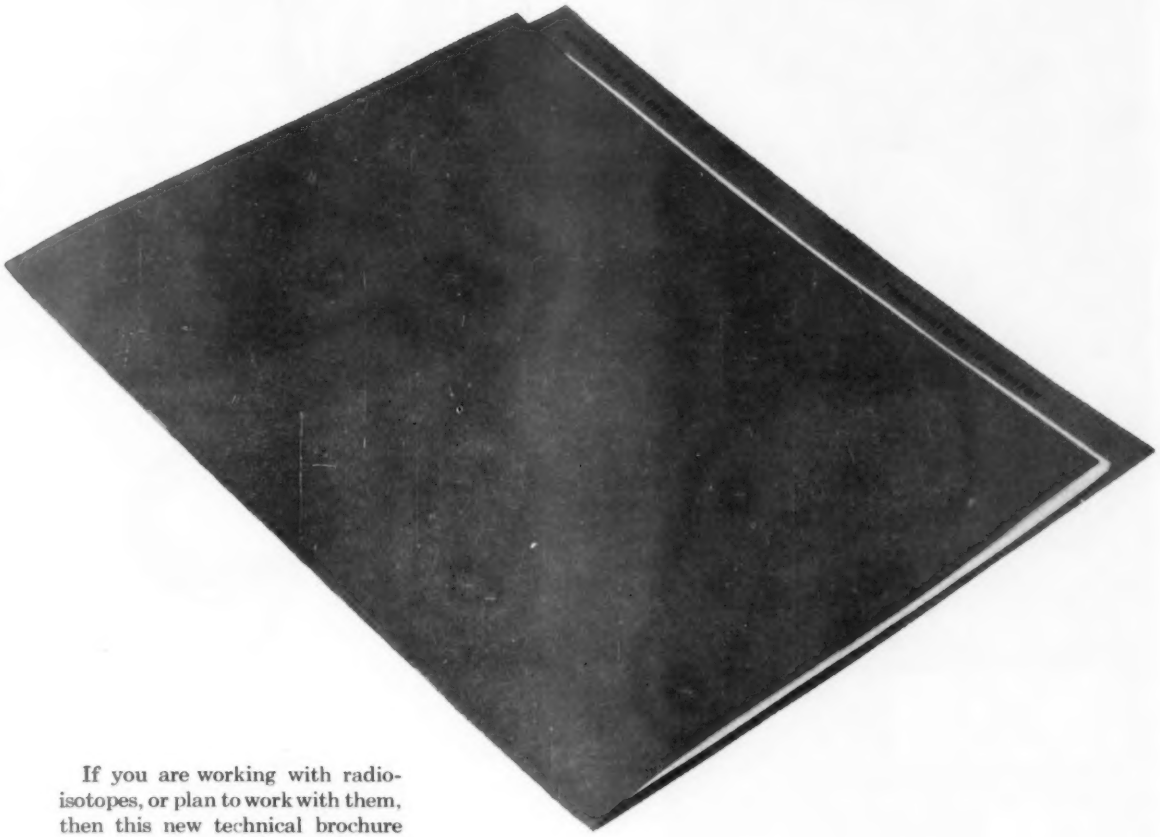
Developing film: When film is exposed to radiations, an invisible or latent change is produced in the film emulsion. Exposed areas become dark when film is immersed in a developing solution. Amount of darkening depends on degree of exposure. After developing, film is rinsed, preferably in a special bath, to stop development. Next, it is put in a fixing bath which dissolves the undarkened portions of the sensitive salt. Then it's washed to remove the chemicals.

continued on page 51

COBALT 60, CESIUM 137, IRIDIUM 192 . . .

the whole story in a nutshell in Ansco's free new

"RADIOISOTOPES IN INDUSTRY"



If you are working with radioisotopes, or plan to work with them, then this new technical brochure is a must for your files.

It gives needed facts and figures on the use of major radioisotopes . . . explains in detail half-lifes, intensity, energy . . . and, describes how each of these characteristics affect exposure time and radiographic quality. It also presents basic exposure factors and compares the quality of radiographs made by exposure to x-rays and gamma rays.

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Industrial X-ray Dept.

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COMPLETING THE PICTURE . . .

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MODEL 52 MULTITRON . . . handling several sources for varying requirements.

"We save approximately 50% of radiography costs on welding inspection by using Nuclear Systems Equipment," said the Manager of Manufacturing at the Chattanooga, Tennessee plant of Combustion Engineering, Inc., last year when Nuclear Systems gamma radiography machines were in use many hours a day. *Now* these machines are used around the clock—and savings over the use of conventional X-ray equipment have increased proportionately. Without expensive rigging, high quality radiographs are being obtained wherever and whenever needed—on almost all sizes and shapes of welded vessels and components.

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NONDESTRUCTIVE TESTING

continued from page 48

Identifying film: Lead numbers or letters taped to objects being inspected furnish a simple means of identification. They are also used as reference marks to determine location of flaws within the specimen.

Handling film: The same precautions taken with photographic film should be taken with radiographic film. Avoid unnecessary pressure, creasing, buckling and friction.

Interpreting radiographs: Correctly exposed and processed radiographs should show any discontinuities larger than the minimum. Lack of fusion, slag entrapment, porosity, cracking, undercutting or gouging are recorded as dark areas, compared with the normal blackening or density of sound metal areas. Other discontinuities —icicles, weld reinforcements, misalignment and spatter—show up as light areas.

Penetrameters are a measurement of the sensitivity of the radiographic technique and source. They determine that the conditions necessary to produce a readable radiograph have been met.

Commercial code-making agencies have agreed that the thickness of a given penetrameter will be equal to 2 percent of the object thickness; it is made of essentially the same material as the part being radiographed.

As a rule, three round holes are machined in a slip of metal. The diameter of these holes is twice (2T), three times (3T) or four times (4T) the thickness of the slip of metal. Lead numbers are attached to the metal and indicate the object thickness they should be used with. The thickness of penetrameters is based on the thickness of metal between the penetrameter and the film.

The penetrameter is usually placed parallel to the weld and approximately ⅛-inch away on the parent metal. If a backing ring or weld reinforcement has been used, shims of the same metal are placed under the penetrameter to increase the thickness under the penetrameter to the same thickness as the weld metal. The penetrameter is usually placed on the source side of the weld, but many codes will accept radiographs where it is placed against the film and the metal being radiographed if a technique can be demonstrated to show that the sensitivity can be judged.

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One object of the penetrameter is to give uniformity. It is not intended to be used in judging the size of a discontinuity nor for establishing acceptance limits for welds.

The fact that you can see the outline of the penetrameter on the film allows you to decide with reasonable certainty that a discontinuity in the same plane and more than 2 percent of the object thickness is not in the weld or adjacent metal. In other words, the outline of the penetrameter reveals that you have contrast sensitivity.

When the image of the hole or holes in a penetrameter are visible, you can determine the detail sensitivity by knowing the "T" thickness of the smallest hole. As an example, the outline of a penetrameter used with a 1½-inch thick weld shows very well (good contrast sensitivity) but the hole location of the 3T hole is the smallest hole visible (detail sensitivity). Therefore, a discontinuity that had a dimension less than 3 percent of the object thickness (3 percent times 1½-inches) or .045-inches might not be discernible. The 3 percent detail sensitivity is not considered good radiographic technique; the standard is 2 percent. Therefore, the radiographer would have to review his technique and change, film source of radiation or focal-film distance to improve detail sensitivity.

At present a penetrameter utilizing 1T, 2T and 4T holes is being accepted; levels of inspection where the 1T, 2T or 4T hole must be seen will soon be the order of the day.

Intensifying screens are used to speed up the radiographic process. They include fluorescent types (calcium tungstate) and lead-foil screens.

Calcium tungstate intensifying screens are a suitable base coated with a thin layer of calcium tungstate. When struck by radiations, the calcium tungstate emits fluorescent light that reacts on the film. Combined effects of radiations and this light reduce exposure time. It also makes possible using X-ray machines on materials thicker than the range for which they were developed.

These screens are seldom used on aluminum or magnesium. Their principal use is on heavier metals, such as steel or copper alloys, with medium voltage equipment. They are not generally recommended for million- and multi-million volt radiography nor for gamma ray work.

Lead-foil screens also have an intensifying action that speeds up exposure time. These screens are generally preferred to calcium tungstate screens when speed of exposure is not critical. They usually provide higher quality radiographs. Their use is almost a must where gamma rays or million volt X-ray equipment are used.

A filter of copper or lead is sometimes placed between the radiation source and the object, or between the object and the film, to diminish the effect of scattered radiation on the film.

continued on page 52

NONDESTRUCTIVE TESTING

continued from page 50

ULTRASONICS make you think of speed in nondestructive testing. This rapidly growing inspection tool employs electronically-produced high frequency sound waves (roughly ¼ to 25 million cycles per second) which penetrate liquids and metals as fast as audible sound.

Ultrasonic inspection equipment has a sound transmitter, a receiver, an amplifying system for the signal, and a means of presenting this signal.

Typical applications of this inspection method in the welding industry are: pressure vessels; nozzles and fittings; high pressure pipe; welded tubing; storage tanks; construction and repair welds; and brazed and bonded honeycomb and sandwich type materials. Ultrasonics will detect, locate and measure defects such as cracks, lack of fusion, incomplete penetration, slag inclusions, porosity, etc.

What are the advantages of ultrasonic inspection?

1. Instantaneous detection of flaws—their size, location, orientation, and degree—usually from one side of work and before expensive machining time has been invested.
2. No waiting for development or interpretation of film. Results instantly shown on scope, recorder, meter, etc.
3. Permits 100 percent inspection at low cost.
4. Good and bad welds can be rapidly and economically separated; process can be supplemented by spot X-ray of questionable areas.
5. Initial capital investment for many ultrasonic units is low.
6. Safety and accuracy not affected by radiation, temperature, or pressure.
7. Much ultrasonic equipment is portable.

As is true with other types of inspection, the success of ultrasonics depends on operator training, experience and skill. He must interpret, analyze, then accept or reject a weld based on his knowledge of welds and test specifications.

There are two ultrasonic systems: pulse and resonance. The pulse-type can be either echo or through-transmission, either of which may be used on contact or immersion inspection.

The pulse echo system uses sound waves generated in short bursts or pulses. Since high-frequency sound has almost no ability to travel through air, it must be conducted to the part either through an oil film between the crystal and the part (contact inspection), or through a column of water (immersed inspection) which varies from a fraction to a few inches.

How it works: When the sound beam hits the part's surface, some of the sound reflects to the listening crystal, converting to electrical impulses, shown as a pip or vertical line on the cathode-ray tube.

The unreflected sound penetrates the part until it is partially reflected by the next interface, normally the opposite side of the part. This echo shows on the screen too, only farther to the right of the first. The space between pips represents the total thickness of the material.

If there is a flaw within the part, another pip will appear between the first two. The flaw becomes another interface from which the echoes bounce. Pin sized ones can be detected if the equipment is on high sensitivity.

The height of pips on the screen gives an approximation of the area of the flaw (if smaller than the crystal). Flaw size is further determined by a comparison with standard blocks of like material which have small drilled holes of varying diameter and depth.

The through-transmission system differs from the pulse echo system in that it uses two crystals instead of one—one for transmitting sound, the other for receiving it. The system works much the same as pulse echo, but will not define flaw depth—only presence and size. The transmission method has greater penetrating power than the pulse type (because of two crystals) and will work on thinner materials.

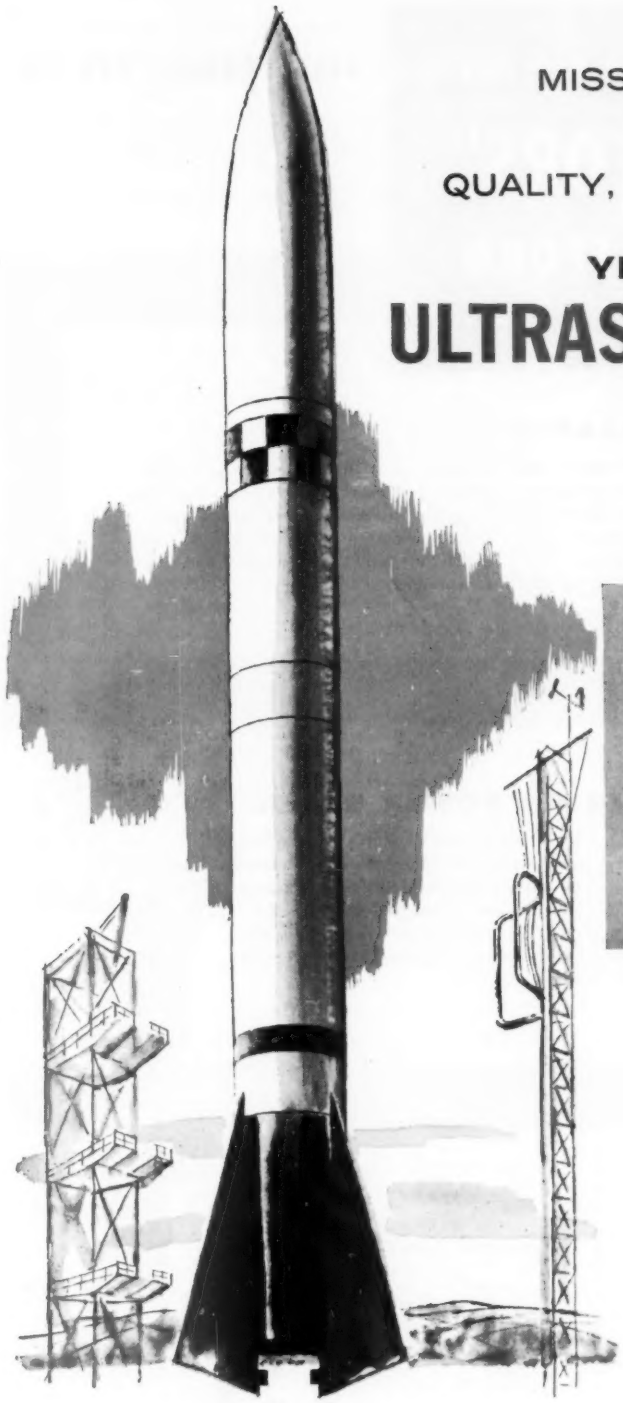
Contact inspection is usually best for portability and penetrating power; the crystal is coupled right to the work with an oil film. Immersion inspection is best for automated setups; scanning and positioning movements can be completely automatic, and tanks as big as 12-feet wide and 54-feet long. Part geometry is less critical with immersion.

The resonance system is principally a thickness measuring device but will locate laminar type flaws. It is not suitable for detecting weld type flaws. In general, resonance works much like other two systems; it differs from them in that the frequency of transmission is constantly varied. The point at which frequency matches the resonant point of the material inspected, is the thickness-determining factor. Like materials, such as a series of aluminum alloys, have an almost constant resonant point.

Ultrasonic inspection equipment and services are available in a variety of ways. One manufacturer will: sell the inspection equipment outright; lease it for a period of 2 months and up; do commercial testing at the customer's plant or their own; do development work on specific problems. A three-day course on ultrasonic theory and practice is offered.

MAGNETIC PARTICLE inspection finds non-visible cracks at or near the surface of a part. It works like this: A magnetic field is set up in the part under test. At the same time, or immediately thereafter, a magnetic material (usually iron powder) is applied to the surface of the part. Breaks or flaws in the magnetized part set up local magnetic fields. These local fields and the flaws that cause them can be revealed by the way the iron powder is attracted to them.

continued on page 55



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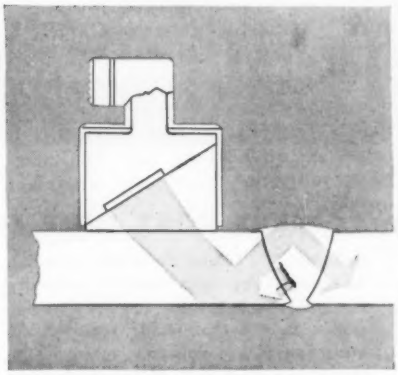

Sound beamed at an angle into the plate passes through a good weld but is reflected back from a void.

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provides down-to-earth answers on weldment quality for every industry. The Reflectoscope locates cracks, lack of fusion, incomplete penetration, fatigue failure, even in the thickest plate and deepest welds. Costs are low. For example, in a recent test of seam welds on a large pressure vessel, Reflectoscope inspection was one quarter the cost of other testing methods. And, there is no radiation hazard.

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LOWEST COST UNIT IN ITS POWER RANGE

Baltospot 200 is also the lightest unit for its rating. X-ray head weighs 85 pounds; rating is 200,000 volts. Low inherent filtration permits top quality radiographic inspection of materials ranging from thin magnesium sheet to 3" of steel. X-ray unit is elastically supported within sturdy but light metal housing. It's shockproof, weatherproof, dustproof, waterproof. Needs no cooling unit or additional accessories. Low tension cables can be conected to any 115-volt, 60-cycle outlet. Simplified controls make x-raying easier than taking snapshots.

OTHER UNITS ALSO AVAILABLE

Shown here: *The Baltograph 260* for portable or stationary radiographic inspection of materials from thin aluminum to 4" of steel.

NEW

Highly versatile *Baltograph 180* for 360° coverage. Rated at 180 KV, 5 ma. End-grounded. Weighs only 98 pounds. It will radiograph a complete girth seam in one single exposure.

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NONDESTRUCTIVE TESTING

continued from page 52

The parts can be magnetized either by direct or alternating current. The former finds subsurface defects and is commonly used for inspecting welds and castings. Alternating current is usually used to check finished machined parts.

Two test methods are available. The wet-method uses a paste of iron powder and oil or water. The part is dipped into this paste or the mixture is poured over the part. This method shows up tiny surface breaks and is effective on parts during manufacture. Fluorescent paste is often used with the wet-method. An ultraviolet light causes the defect to stand out brightly and, in effect, increases sensitivity.

The dry-method is more sensitive to subsurface defects. Here, magnetic powder is dusted or blown over the part to be inspected.

Portable magnetizing equipment is used on difficult-to-move weldments, heavy castings or on fixed structures. The magnetization source is taken to the object being magnetized. A current of 500 to 6000 amps and 4 to 18 volts is used.

Two means of magnetizing are available: Heavy insulated cables are coiled around the parts or prods are used to make electrical contact and pass current through local areas of parts. The latter magnetizes with an internal circular field.

Stationary equipment is used on smaller parts for hand or automatic inspection. In either case, parts are magnetized with a coil that induces a longitudinal magnetic field in the part. An alternate method is to clamp parts between two contact plates that pass current to create a circular magneic field within the part. Often, parts are magnetized in both directions during inspections to show up defects in transverse and longitudinal directions.

It is generally agreed that an AC supply is practical only when surface defects need be located. These sources are less costly than DC; they do not indicate confusing subsurface defects—especially when they are not important.

Magnetization with direct current is generally considered where subsurface and surface crack-like defects must be found. With it, the magnetic field extends within the part itself and magnetic leakage fields are produced on the surface by interruption in magnetic path below the surface.

Half-wave DC is a practical supply for subsurface defects, especially where the outer surface is rough. Current is rectified half-wave from a single phase AC source at high amperage and low-voltage level. Many fabricators of heavy industrial equipment use such tests to check for cracks or welds and castings. Heavy, thick welds can be inspected several times during the building up of the weld.

Dry magnetic powders are used for most portable types of inspection. Red, gray, or black powders give needed contrast with color of part being tested. Dry powder permit maximum sensitivity for deep, subsurface crack-like defects.

Wet magnetic particles are usually used with DC for finding small subsurface seams and inclusions within a few thousandths of an inch below the surface.

Many standard sizes of portable equipment are on the market, ranging from small hand-held magnetic yokes to large 6000-amp heavy-duty power units. Smaller sizes up to 1000-amp capacity are less sensitive; their usual output is AC. Higher amperage group, supplying 3000 to 6000 amps, can be had in AC or DC. When inspecting medium-sized welds and castings, the equipment most widely used handles both AC and half-wave magnetizing current. The operator may select and control sensitivity in finding only surface cracks with AC or he may find surface and subsurface defects with half-wave current. All equipment larger than the 500-amp size operates from 220 or 440 volt, single- or 3-phase AC supply lines.

Hand-operated stationary horizontal equipment is being used widely. Units usually have a built-in tank to keep wet particle bath agitated and to supply a hand hose for the operator. Almost completely automatic units are also in use. Here, inspection is carried on automatically on a steady flow of conveyorized parts.

Prices of inspection equipment range from around $200 for a small, portable unit to as much as $50,000 for larger or specialized equipment.

Commercial inspection services are also available. Inspection can be made in the customer's plant or in the service company's laboratory. The customer pays for this service by the piece or by the hour.

PENETRANT INSPECTION

is usually used to examine non-magnetic, nonporous materials for defects that open to the surface. Materials tested include aluminum, magnesium, brass, stainless steel, titanium, ceramics, carbides, glass and plastics.

Surface defects that can be located are all types of cracks (connected with welding, forging, grinding, shrinkage, fatigue), porosity, seams, laps, cold shuts and lack of bond between two metals.

Because penetrant methods are restricted to surface defects and because part cleanliness is important, these methods have been used mostly to inspect nonferrous and nonmagnetic materials.

There are two kinds of penetrant inspection: dye and fluorescent. In either case, the penetrant is applied by brushing, spraying or dipping.

In dye penetrant inspection the penetrant is applied to a clean, dry surface and allowed to soak for a while. The dye penetrates surface defects. Excess dye is wiped off and a thin coating of a developer chemical is applied. The developer draws the dye to the surface like a blotter.

continued on page 56

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FEDREX-140KV LIGHTWEIGHT X-RAY

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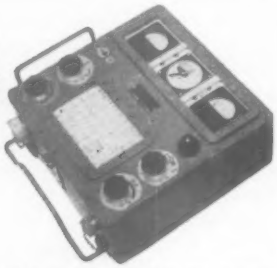
FEDREX 140 LIGHTWEIGHT CONTROLS



Dimensions: 7" x 14" x 14"

The 140 automatic is designed with special regard to the requirements of the welding industry—preset kV and mA exposures can be made in series through application of the exposure button. Regulating range of 140kV covers most requirements on today's welding jobs—The control panel is equipped with signal lights for X-RAY "ON" and for thermal switch built into tubehead.

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Stepless kV Range	30-140	Instrument Lights	12 volt
Stepless mA Range	2-5	Hand-Lamp Connection	12 volt
Power Supply—60/A.C.	110-220 or 220-440	Power Consumption	800 VA
		Max: Current—Full Load (220 volt)	4 AMP
Variations for	±12%		

FEDREX X-Ray models available also in the 160-200-260kV sets and a 160kV/360° set for exposure of circumferential welds.

140 kVLL
F 675

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NONDESTRUCTIVE TESTING

continued from page 54

Contrast between the color of the developer (usually white) and the dye penetrant (usually red) outlines surface flaws.

Portable spray-on dye penetrant kits are widely used.

In the fluorescent method, the penetrant is applied just like the dye penetrant. But, the surface is inspected under ultraviolet light. Cracks or flaws glow brightly under this light.

For portable applications all materials are available in pressurized spray cans.

Because of water-washable penetrants, this method is popular for volume inspection to locate surface cracks and porosity in quality nonmagnetic parts such as gas-turbine buckets and stainless, aluminum or magnesium parts that are cast, forged or rolled. Parts can be run in batches.

FREON TESTING is an extremely sensitive method of leak detection. The unit under test is pressurized with an inert gas containing a tracer, usually "Freon 12." The areas under test are "sniffed" or probed with a sampling device that is sensitive to the halideion. The presence of a leak is indicated on a meter and/or by an audible alarm. It is possible to quantitatively measure a leak by using standards.

HALIDE LEAK TESTING is a less sensitive method of detection in which the unit under test is pressurized with air contain a trace of "Freon 12." The areas under test are "sniffed" or probed with a halide torch. The presence of a leak is indicated by a change in color of the torch flame caused by the Freon.

THE MASS SPECTROMETER leak detector is the most sensitive and accurate instrument known for indicating extremely small leaks. (All methods of leak detection involve the passage of a "tracer" medium from one side of a presumed leak to the other and the subsequent detection of the medium on the latter side). It measures the rate of a "tracer" gas, usually helium, through the leaks. Key is a sensitive sensing device that detects the helium gas and converts it to an electrical signal. The location and size of a leak is determined on the basis of this signal.

There are three types of leak detection that can be done with a helium mass spectrometer: vacuum testing, pressure testing and pressure-vacuum (inside-out) testing.

EDDY CURRENT TESTING can detect faults in the form of cracks, seams, laps; changes in structure; chemical composition, hardness, conductivity, permeability; and size of test piece. This testing method is based on magnetic induction in which a magnetic field induces eddy currents within the material being tested. The magnitude and phase difference of these currents is, in turn, reflected in the actual impedance of the pickup coil. Careful measurement of this impedance is the revealing factor in detecting defects.

Instruments available do their job on a fully automatic high speed basis. Parts may drop or pass through a coil, or a probe-coil can be moved over the surface of a part. In either case, the basic principle is inducing eddy currents in the parts and detecting the effect of these currents on a measuring coil or probe.

INFRA-RED HEAT is common to three testing methods used on brazed, soldered or welded structural assemblies, such as checking the bonds between stainless steel honeycombs and skin panel surfaces.

The first two—developed by Magnaflux Corporation and the Martin Company—are described and illustrated on page 59.

The third method was developed by Pioneer Industries, a division of Almar-York Company. This firm's "Hot Shot Tester" was designed to provide a simple and rapid method for detecting poor quality brazed joints in brazed stainless steel structural assemblies. Such areas frequently occur in high temperature brazing because of contamination or oxidation of the faying surfaces which causes a panel to fail at a lower stress level than the design limit. Such contaminated areas are not ordinarily detected by radiographic or other inspection methods.

These brazed assemblies are tested by applying a controlled and recorded heat to a given area of the skin for a specific controlled time. Heat is produced by a flash heater equipped with infra-red heating elements.

An induced stress which can be readily calculated is produced in the heated area. Since the induced stress is proportional to the time of the test and the temperature of the skin, the panel may be tested at a pre-determined stress below the design limit. Areas containing proper braze are not affected, while areas with a poor quality braze fail. A test or standard panel with the same skin thickness and structural characteristics as the structures being tested is used to determine the time required to produce the particular temperature and corresponding stress needed in testing. • •

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NONDESTRUCTIVE TESTING:

how the welding industry uses it

Ample proof that manufacturers want the latest inspection and testing equipment is given on these pages; it saves them money and helps keep them competitive.

Spectrometer detects leaks

The Detroit plant of the Stainless Processing Div., Wall Colmonoy Corp. has installed a mass spectrometer leak detector to document leak-proof joints on their controlled atmosphere or vacuum furnace brazing production.

The mass spectrometer exhausts parts to below 1 micron pressure for vacuum testing with helium. This provides unusual sensitivity.

A typical brazed assembly is tested with helium (an ideal tracer medium for vacuum leak detection), after all orifices are plugged and the vacuum drawn. Conventional equipment is beefed up with roughing and diffusion pumps to attain the high vacuum.

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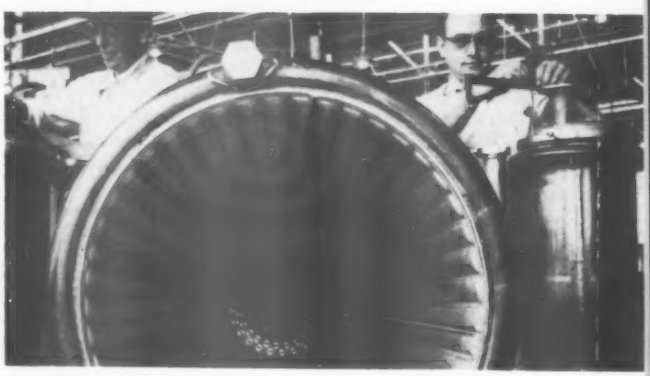
Missile motor X-rayed



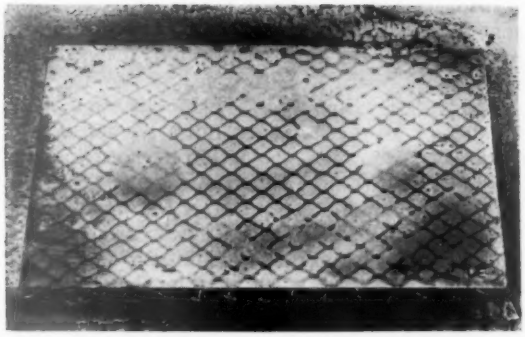
The Army Corporal, a 10-ton surface-to-surface guided missile, is hurled over a hundred miles at better than Mach 3 by a Ryan Aeronautical Company (San Diego) rocket motor.

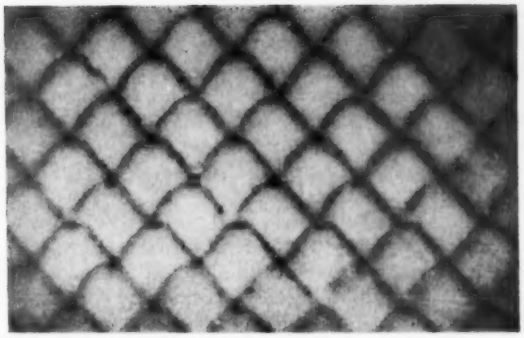
Constructing this power plant so that it will take tons of pressure and metal-melting blasts of heat is a tough job. Tolerances are held as close as ten thousands of an inch, heavy metals are used that take kid glove welding and forming; and close inspetion with X-ray and other processes is required.

Brazed seams must be porosity-free, flawless and fuel-tight. Ryan determines this by X-ray; the hour glass-shaped images on film become part of a rocket motor's record.

Once a rocket is fired it's gone forever. So Ryan final-tests the Corporal by "firing" them with water. Two tons a minute are pumped through a motor, flow rates and pressures are measured, then converted to performance rates.

Each motor shipped carries its pedigree—the X-ray photo, and inspection and performance reports. The men who will fire it will know exactly how it will perform.





Two new, simple methods check honeycomb bond

The bond between metallic honeycomb, soldered, welded, or brazed to the skin surfaces, can be checked by Bondcheck, a new development of Magnaflux Corp. The skin surface is cleaned, then sprayed with a red fluid that is repelled by heat and flows to the coolest areas. Next, the part is heated with an infra-red lamp. The heat travels from surface to core wherever a good bond exists between them. Thus, the fluid flows to the bonded areas, reproducing the pattern. Deformed cores will show a distorted pattern.

The testing kit is highly portable; main components (besides cleaning and inspection fluids) are a spray gun, and a lamp heat intensity control that operates on 110 volts.

The test is fast. Accurate results in production-use require good techniques and timing. Complex shapes can be tested, and automatic testing is practical on simple shapes.

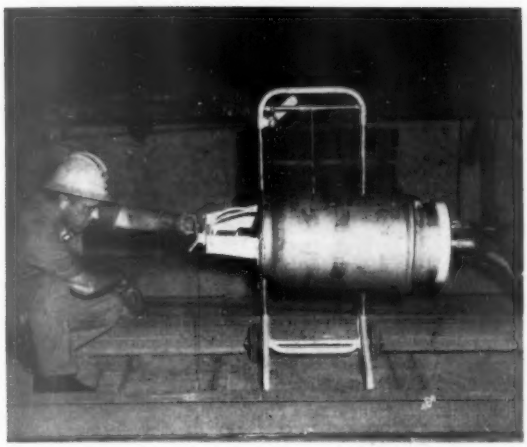
Circle No. 104 on Reader Service Card.

A new, easy and accurate way to detect flaws hidden beneath the skin of composite panels, like a brazed stainless steel honeycomb panel, is under test at the Martin Company's Baltimore Division Materials Engineering. It's the thermograph. It stands a good chance, too, of being used at Martin for continuous inspection or quality control work.

The top surface of a panel is coated with an oil film and infrared heat is applied underneath. The heat conducted upward by the honeycomb core displaces the surface film and shows a pattern of the core where it is joined to the skin.

Thermographs clearly show irregularities in cell patterns, excess brazing material at junctions, and intimacy of the core-to-skin contact. They provide an instantaneous, extended coverage picture that can be interpreted visually or photographed. Current external inspection methods indicate the soundness of a bonded structure only locally and indirectly.

Shipyard radiographic units must be portable



At the New York Naval Shipyard, portability of radiographic equipment is extremely important. Ships under construction or repair can't be brought to the equipment; the equipment must go to the inspection area. This is field inspection, and is as true of pressure vessels and storage tanks as it is of ships.

The Shipyard has experimented with a number of portable radiographic units—both X-ray and gamma-ray. They have adopted those best for their needs.

A typical unit used at the yard is a 100 lb. 275 KVA unit mounted on its own two-wheel truck. It's seen being set up to inspect a ship-bottom shell weld. The power unit can be as far as 500 feet from the head. Setting up is simple: only power and water lines need be connected.

STAINLESS CLAD

continued from page 27

heads are finished this way before they are welded to the tank cylinder.

4. Alloy Fabricators welds the longitudinal seam from both sides, using manual and automatic welding. This joint takes a lot of metal: 7 passes manually and 8 to 41 passes with the submerged arc process.

5. To be positive of a good weld, the longitudinal seam is X-rayed at intermediate thicknesses, stress relieved and X-rayed again.

6. The fit-up man then tacks and prepares tank ends to the cylinder for automatic welding. The procedures for making these circumferential welds are shown in the chart.

7. After the tank is welded completely, Alloy Fabricators X-rays all circumferential welds, stress relieves the whole unit in a large furnace and rechecks all welds again with X-ray. Then all welds are checked with dye penetrants for surface defects and each tank is hydrostatically tested at 3000 psi. As a final step, the vessel is fitted with its agitator assembly and a running test is performed at the 2000 psi working pressure. • •

AUTOMATIC FIXTURING

continued from page 37

Station 3: The operator uses an air press specially designed by Mueller. It crimps the retainer ring which locks felt washer and flat washer to the top housing. At the same time, on the press down stroke, the felt washer is lubricated with a shot of grease.

Station 4: At this station an operator induction solders a brass tube to a cover housing. This fixture operates the same as the one at station 1. The only difference is that this operation is in the line and the part is fed to the conveyor belt which feeds station 7, the final opertion of the assembly.

Station 5: With an air press this operator pushes the actuator rod through felt washer and the rubber O-ring of the top housing. The housing is then placed on a slotted inclined chute—sliding the housing to an assembler, who sandwiches the neoprene diaphragm between two retainers.

Station 6: Is located at the bottom of the slotted chute. The press operator loads top housing to a bottom die in the press. At this point, Mr. Mueller interrupted and said that this press was specially designed to do two things—spin and peen the actuator rod end at the same time, avoiding possible damage to the diaphragm. To do this, he said, the machine's top die had to be air operated at a given vertical pressure. At the same time it had to be power rotated to give the spinning action.

Station 7: The last and final operation, a mechanical press operator, the only male in the line, crimps the top housing and cover housing with a curling die finishing the assembly.

Inspection and Testing: Every actuator is inspected as it comes off the line. Moreover stiff process tests are made. They are destructive tests. One tests the fastening of the vacuum intake and exhaust tube. No matter how twisted or bent, the tubes must go before the soldered joint. The projection welded mounting studs and retainer ring must meet a similar test. Still another test specifies that leaks must be less than 0.001 cfpm of air at 20.0″ of Hg vacuum and at 75° plus or minus 5°F.

Tight control on working tolerances, fixturing and good soldering and welding procedures keeps defects down. For a 10,000 piece daily run his total percent of defects were under one percent. • •

MULTI-SPOT WELDING

continued from page 35

bar outward. That ensures good welds by ironing out any gaps between the cover and the front cross bar. While the welding is in process, the machine goes back for another part. The welded parts then go through 3 idle stations into the second welding stage. It duplicates the first, using the same timer to sequence and fire its 2 transformers simultaneously with the first stage.

A. O. Smith's assembly lines are semiautomatic. Each has an automatic straightening machine to correct distortion. After the frame leaves the straightening machine, all critical mounting holes are pierced in a single automatic operation.

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The A. O. Smith Corporation ships all frames on railroad flat cars it designed. They take 108 frames per car.

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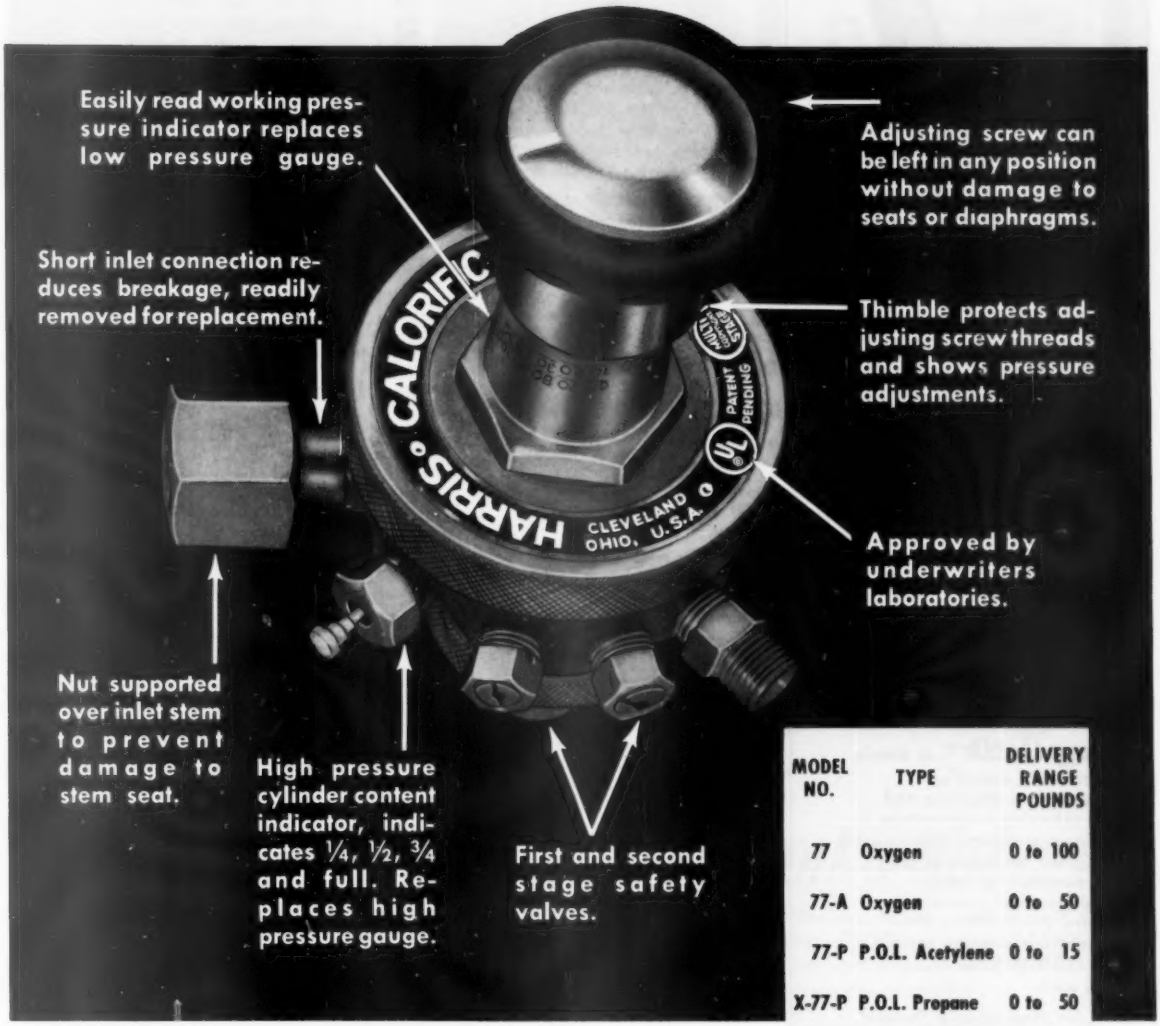
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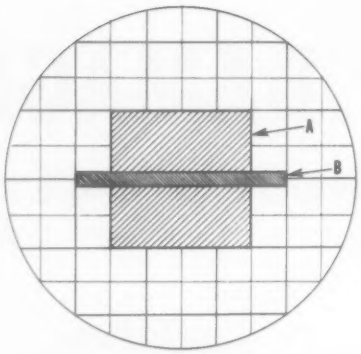
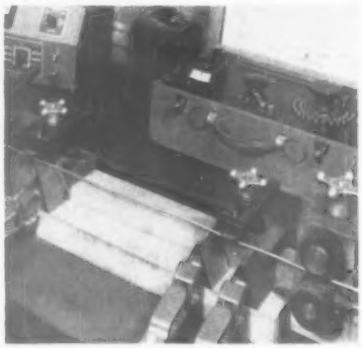


CYCLOGRAPH is a comparison device that sorts out stainless alloys. Position A on screen shows standard pattern. Position B illustrates typical shift when foreign material is introduced.



MEASURING resistivity of stainless alloys picks out a strange analysis that may have crept in through error.

GROUPING FOR CYCLOGRAPH SORTING

Group A	Type 316, Type 310
Group B	Type 308, Type 309, Type 347
Group C	Type 312, Type 349
Group D	Straight Chromium Grades

RESISTIVITY OF STAINLESS STEEL WELDING ELECTRODE CORE WIRES

Grade	Resistivity, ohms/circular mil foot
308	390 – 345
309	430 – 450
310	465 – 500
316	410 – 450
330	520 – 545
347	395 – 445
349	420 – 440
502	190 – 230
410	270 – 320
430	305 – 335
442	320 – 340
446	340 – 335

2 Quality Control Procedures Identify Stainless Wires

by **HARRY F. REID, JR.**, *manager, Technical Service Division, McKay Company*

IN BRIEF: Increased use of stainless and the development of new alloys makes telling them apart progressively harder.

FOUR OR FIVE BASIC types of stainless no longer are adequate to meet critical industrial requirements. Today, more than 30 different types of stainless electrodes are available. Twenty or more different grades of stainless wire must be stocked to make them.

Identifying these is complicated by the number of sizes of each specific grade. Coils weighing anywhere from 100 to 500 pounds are received; each is a separate identification problem.

The problem is simplified somewhat because each coil has been identified by the producer as to type and size. This identification must be double-checked and maintained at all stages of subsequent production.

At McKay, we use two quality control procedures to identify various analyses of stainless wire.

In Cyclographic identification the Cyclograph acts as a sorting and secondary identification tool. Wire of a known analysis is inserted into a test coil. An oscilloscope is adjusted to the image on the screen which is of a regular, uniform pattern. Then the known wire is removed. Wires to be screened are then inserted into the coil in rapid succession. Changes in composition are indicated by a marked shift in the size and shape of the image on the screen.

The Cyclograph is primarily a comparison device. It gives no clue to chemical identification of a foreign material. Accuracy of identification increases as the difference in chemical composition become more pronounced. Some of the alloys separated successfully using the cyclograph are divided into four groups (see accompanying chart). Separation of individual alloys within any one group, however, is less precise.

Best results are obtained using wires 5/32-inch in diameter or larger. Sensitivity to the test method decreases as cross-section of the wire decreases. Tests made using 5/64-inch or 1/16-inch diameter wire are not considered reliable. This limitation might be overcome by using a coil designed for fine wire.

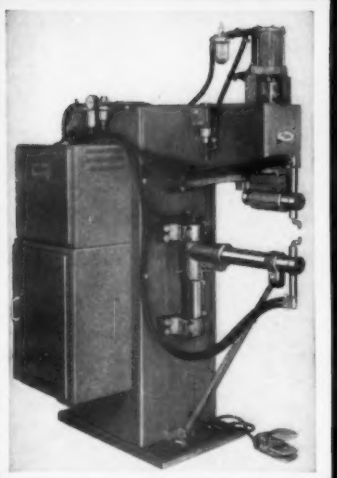
Resistivity measurement: Direct measurement of the resistivity of stainless wire provides a second method of identification. Such testing is not limited to a comparison with a standard wire, but directly measures resistivity. This alone is not enough to positively characterize a steel, but it does pick out in a majority of cases a strange analysis which may have crept in through error.

The test method is not so rapid. Nor can it be adopted to sorting problems as readily as the Cyclograph. But it is applicable to fine wires.

In our resistivity measuring equipment a length of wire is stretched tautly between knurled end grips. This provides a one-foot length of test wire. Current of known characteristics is introduced and resistance of

continued on page 65

For More Information Circle No. 7 on Reader Service Card.



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WATCHEMOKET OPTICAL CO., INC.
232 West Exchange St. PROVIDENCE 3, R. I. In Canada: Levitt-Safety Ltd., Toronto 10, Montreal 26, Winnipeg
For More Information Circle No. 77 on Reader Service Card.

Circle No. 75 on Reader Service Card.

Wolverine
TOGGLE CLAMPS

Note These Important Features:

✓ HARDENED PINS and BUSHINGS
✓ BLACK OXIDE FINISH
✓ HEAVY BODY SECTIONS
✓ PINS RIVETED FLUSH
✓ DROP-FORGED ARM

CQ-1100 Series

C-130 Series

CQ-800

Wolverine Clamps are available in a variety of styles, sizes and mountings.

Write for Bulletin 59-C

WOLVERINE TOOL CO.
1482 E. WOODBRIDGE
DETROIT 7, MICH.

Speed-Up WELDING
WITH SUPERIOR'S BENCH MODEL
POSITIONER-TURNTABLE

Complete with Foot-Control Switch

Weighs 20 Lbs.

LOW PRICE • HIGH QUALITY

Holds work in any position from vertical to horizontal and will carry 100-pound load.

Smooth, stepless speed change, both forward and reverse, from zero to 6 rpm—greater speed if desired. Ideal for aircraft work.

Reduces rejects—increases output up to 25%. Gear driven motor, v-belt transmission with tension control, built-in ground for more uniform welds.

Good Distributor territories still open • Write for details

For additional information, write or wire to:

SUPERIOR WELDING CO.
3410 E. 14th St., Los Angeles 23, Calif.

Circle No. 66 on Reader Service Card.

METHODS ENGINEER at Euclid Division of General Motors Corporation, Cleveland, Ohio, makes sure welding operator is getting specified welding current.

Tong Tester Gives Instant Checks On Welding Current

IN BRIEF: Incorrect welding current can cause poor welds; tong testers are a fast way of making sure you are getting specified amperage at all times.

THERE'S ONE BEST WAY to do every welding job. Sometimes it means using alternating current. Other times it means using direct current. But, whichever you use, the thing is to get the current specified for each job, at all times. This can be made difficult by variations in welding current caused by irregular power input and the wear and tear of daily use on welding machines, cables and holders. Sometimes manual or automatic welding machine dial settings are off as much as 50 to 250 amps. An experienced operator would spot the difference immediately. But, a novice might never know the difference. It would be only after the welding is done that an inspector would notice poor weld quality.

Here's what happens in manual welding when the current is either too high or too low. Take an E 6012 electrode for instance. When an operator uses current lower than called for, he gets a rough surface, poor fusion and low metal deposition rates. With current above the specified range he gets bad undercuts, uneven slag, excessive weld spatter and porosity.

One of the best ways to check current is with tong test ammeters. They come in several models—for alternating current, for direct current or for both—and can take readings without breaking the circuit or even touching the conductor under test.

Here are some of the defects you're apt to find in plants that do not check their welding machines and cables regularly:

1. Power and ground cables wear and break causing current loss at the welding electrode.

2. Motor generator sets develop bad brushes and burned commutators which lower current output.

3. Metallic dust and dirt break down selenium stacks in AC/DC rectifiers. Some rectifiers have filters and others do not. Dirty filters can do more harm than good. Poor fan circulation cause rectifiers to overheat. As this happens, current output drops

off. Severe overheating will melt and short out the stack.

A preventive maintenance program which checks for these defects can be set up easily. Use a simple reminder card system. Make a card out for each welding machine and write in the date when checks should be made. These periodic checks can be made by the welding foreman or engineer using a tong test ammeter. • •

IDENTIFYING STAINLESS

continued from page 63

the wire is measured directly on No. 4285 Kelvin Bridge Ohmmeter. Scale readings then are converted to the standard designation: ohms of resistance per circular mil foot.

Resistance of samples cut from a number of coils of wire from the same heat may vary as much as 10 to 12 ohm per circular mil foot. The spread of values obtained by testing a number of heats of the same alloy wire may be considerably wider. The effect of these variations is illustrated in the spread of some of the measured values listed in the accompanying chart. • •

INSIDE-OUT WELDING

continued from page 31

the top hemisphere clamped to the base with chill bar tooling. Then the tailstock and turning rolls are positioned, aligned and secured.

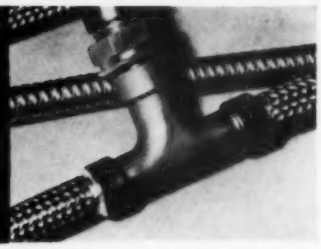
The ram is lined up in front of a 10″ port and the machine started. The ram moves into the sphere to a predetermined point, the arm lowers, and the welding head rotates into welding position. Inert gas flows, an arc is struck and wire feeds to the weld puddle as the positioner turns the sphere through 360 degrees.

When the weld overlaps slightly, the arc and gas flow stop, and the manipulator repositions for another operation.

With the addition of lateral ways, special positioners, and automatic roll planishers, the Lockheed machine can be made to perform any mass production fabrication task with automatic welding. • •

For More Information Circle No. 5 on Reader Service Card.

SOLDERING PROBLEM?
stainless to aluminum?
aluminum to copper?
cast iron to steel?



You get high strength with ALL-STATE special solders

BOEING 707 Landing Gear Harness
Braided stainless steel wire and flexible conduit had to be joined to cast fittings. Brazing burned the fine wire. ALL-STATE had a special solder which solved the problem. (See #430, below.)

#7 Special solder for cast iron 450-600°F. Withstands 1000 psi P.

#37 Developed for joining aluminum with soldering iron at low 450°F. Good color match and corrosion resistance. Also joins dissimilar metals. 1000 psi P.

#39 Special solder to join all types of aluminum for both build-up (450°F) and capillary flow (650°F) – with or without flux. 8000 psi T.

#55 Newly developed aluminum "rubbon"® solder – NO FLUX – 705°F – 20,000 psi T. All aluminums.

#105 Special medium temperature alloy for both ferrous and non-ferrous metals (640-740°F) – to 25,000 psi T.

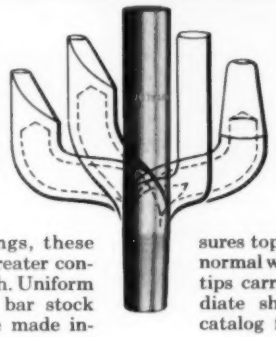
#107 The finest made to join aluminum to steel, copper and brass – or to each other (480-600°F) – to 25,000 psi T.

#430 NO LEAD, NO ZINC or CADMIUM – develops tensile strengths of 10,000 to 28,000 psi on stainless and dissimilar metals. For soldering iron at a low 430°F.

Send for ALL-STATE Instruction Manual. ®RUBBON is a registered trade name.

All-State
Distributor-Stocked, convenient to buy. Economical to use.
ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y.
Call WHite Plains 8-4646 or write for nearest distributor

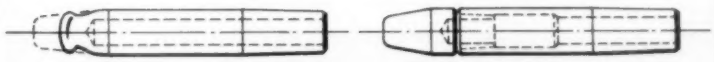
Are You Yet Using Cast Tips?



TUFFALOY
Cold-Formed Tips Are The Answer

Compared to castings, these Tuffaloy tips show greater conductivity and strength. Uniform high quality of the bar stock from which they are made insures top performance under all normal welding pressures. Many tips carried in stock for immediate shipment. See Tuffaloy catalog for this wide selection.

TUFFALOY® Spotwelding Tips



Are You Throwing Away 90% of Worn, Mushroomed Tips?

With Tuffcap®, You Replace Small Tip only, Re-use Shank

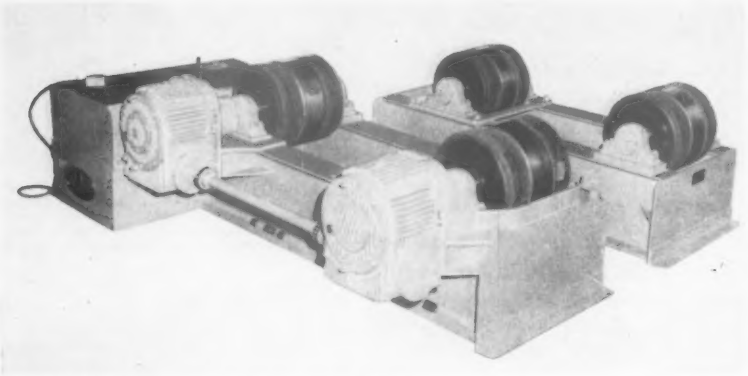
With care Tuffcap shanks outlast many Tuffcap tips, interchangeable in four standard nose designs. Tips are easily replaced, reducing holder wear and down-time of machine.

Tuffaloy resistance welding alloy products are widely available through Airco and Tuffaloy representatives. Call on them for SPOTWELDING TIPS (Standard, 'Tuffcap', Cold-Bent, and Special), Holders and Adapters, BAR STOCK, FORGINGS, SEAM WELDING WHEELS, and all other welding alloy needs. Ask for Catalog and Price List.

AIRCO®
AIR REDUCTION SALES COMPANY
A Division of Air Reduction Co., Inc.
150 East 42nd Street, New York 17, N.Y.

For More Information Circle No. 70 on Reader Service Card.

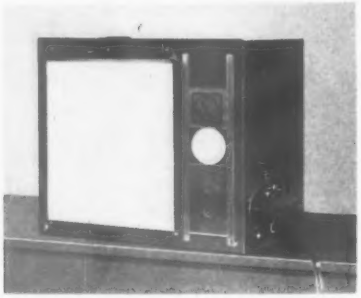
NEW PRODUCTS



Controlled Torque Turning Roll

A new turning roll powered by a 5 hp variable speed drive through a torque coupling to prevent damaging or jamming of gear boxes, has been introduced by the Webb Corporation. The roll with a 300,000 pound capacity (1 power-2 idlers) will not let vessels slip because the control device is ahead of the final control drive reducers. Supporting wheels are sandwiched rubber-and-steel mounted on Dodge-Timken pillow blocks.

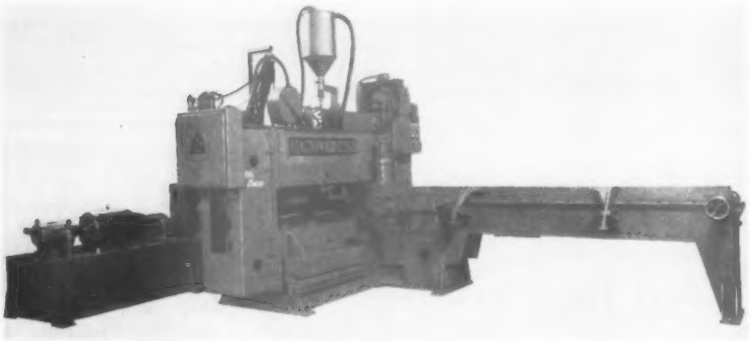
Circle No. 83 on Reader Service Card.



Film Illuminator

The Curtis-Wright Corporation has announced a new high intensity film illuminator for viewing x-ray and gamma-ray radiographs. The unit can be used for examination of 14" x 17" radiographs, smaller sizes and strip film. It features easy reading with high film densities, easy light source replacement, wide variable intensity and has a foot switch control.

Circle No. 80 on Reader Service Card.



New Strip Splicing Machine

Berkley-Davis Incorporated has introduced a new strip splicing machine. The machine is designed for use in a continuous tube mill installation and it splices coil stock up to 14" in width and ½" in thickness.

The machine consists of an entrance table, a double down cut shear, a welding station, and a broaching station. A set of pinch rolls on an exit table helps control the ends of the skelp.

Submerged arc is used to weld 5/16" thick stock. The weld is made in one pass, and is not noticeable in the finished tube.

Circle No. 84 on Reader Service Card.

New Safety Spectacles

A new safety spectacle, manufactured by Welsh Manufacturing Co. features a unique universal bridge which fits more than 95% of employees without need for adjustment. Bridge blends comfortably to nose contours, Modern butt-joint temple construction provides extra strength and better fit.

Avaliable in three styles and three colors. Lens shape and construction in S7 square shape clear or green heat-treated glass and CR 39 plastic.

Circle No. 81 on Reader Service Card.

New E-6011 Electrode

The Lincoln Electric Co. has announced Fleetweld 180, a new E-6011 electrode for arc welding sheet metal and for general maintenance welding with small transformer welders.

Lincoln says that the electrode can operate at currents as low as 50 amperes and that its light slag make it possible to weld .036 inch (20 ga.) material without burning through. When current is increased, the arc becomes forceful and deep penetrating, making the electrode suitable for general repair welding. Fleetweld 180 is available in 3/32", ⅛", and 5/32" sizes.

Circle No. 85 on Reader Service Card.

Temperature Checks

Tempil Corporation announces newly developed temperature-indicating pellets for 525° and 650°F. These temperature ratings now fill the gaps in Company's wide range of pellets that now cover a complete range from 100°F to 2700°F in 90 systematically spaced intervals.

The 525°F pellet falls in the tool steel tempering range and in the thermo-setting level of some of the new epoxy resins. The 650°F pellet also falls in the tool steel category. It is used in the heat treating of aluminum alloys and non-ferrous metals.

Circle No. 82 on Reader Service Card.

FACTS AT YOUR FINGERTIPS: *Do you want full information on the latest welding products shown on these pages? Just circle the appropriate number on the bound-in readers service card and you'll get it.*

NEW!

HANDI-ARC ELECTRODE HOLDER

This new HANDI ARC gun is full of all new features, each designed to give you greater Production, Economy and Safety. The exclusive pistol grip design is in the modern trend in production tooling. The point-to-point visibility makes for better welds and its micro-grip holder provides complete electrode consumption . . . no stub loss . . . First saving is a sure 15% in welding rod costs.

With the New Jaws you can see the entire welding operation down to the end of the coated rod.

The trigger control allows operator to get into the most difficult spots with ease and perfect control.

The pistol type trigger switch insures safety at all times. HANDI ARC is completely insulated from operator.

Internal parts are all of high grade copper, and precision made for dependable use.

Feature for feature, HANDI ARC gun is the finest electrode holder at any price. BUY NOW and start saving immediately on time, labor and material. Satisfaction fully guaranteed.

Handle is of high impact Phenolic plastic designed to give many years of hard service. The vivid red color helps identify HANDI ARC and locate it on sight anywhere. Design of handle with trigger control prevents accidental arc flashes when working in close quarters or when left on bench or work tender.

The Universal Jaws can be adapted to handle any electrodes from 3/32 to 3/16.

Improved push button stub ejector eliminates waste, and burning of insulation and handle.

No matter what holder you now use, you will be interested in seeing the New HANDI ARC holder. Use it on the job and See How It Cuts Cost For You. Send this coupon:

Special Introductory Price

$24.50

For Limited Time only.... (CABLE NOT INCLUDED)

See us at the A. W. S. Welding Show, Chicago, April 7, 8, 9; Booth 504

TRADE MARK
PAT. PENDING

FRANK NIEMI METAL PRODUCTS, INC.
MANUFACTURERS
Woodlawn Ave. Gurnee, Illinois

We want to See HANDI ARC gun type Electrode Holder and see how it will cut costs for us.

- ☐ **Ship sample HANDI ARC Holder at your Introductory Price of $24.50.**
- ☐ **Send New FREE DATA BROCHURE**
- ☐ **Send Dealer Offer.**

Name .....
Company & Title .....
Street .....
City ..... State .....
(Shipped open account to rated concerns.)

For More Information Circle No. 55 on Reader Service Card.

For More Information Circle No. 22 on Reader Service Card.

NEW!

STAINLESS STEEL WELDING SCALE & OXIDE REMOVER

Ox-Off 536, an exciting new chemical formulation, removes most types of welding scale and oxidation from stainless steels in only seconds. Eliminates costly, time-consuming hand grinding, sanding, and compounding methods. Large pieces rapidly and effectively treated by only one or two strokes of hand applicator—small pieces by immersion in a quick-acting bath. **Just one try and you'll buy.**

DISTRIBUTOR INQUIRIES INVITED

Chemclean Products Corporation

15-08 121st STREET • COLLEGE POINT 56, N.Y.

TOP WELDERS . . .
even the "Gals" like
MANGANAL®
11%-13½% MANGANESE-NICKEL STEEL
BARE WELDING ELECTRODES

Mrs. Mildred Fisher of John H. Fisher, General Welding, Wilmington, Delaware finds Manganal Bare easy to use to make the strongest welds faster. Manganal Bare has no coating; leaves no slag; eliminates chipping. Workhardens to 550 Brinell; tensile strength 150,000 psi. It is 100% metal; the most effective and economical electrode to use for reclamation welding. The proof is really in the use of Manganal Bare. Try it and see for yourself.

MEMBER NATIONAL WELDING SUPPLY ASSOCIATION

SOLE PRODUCERS

STULZ-SICKLES CO.
929 JULIA STREET • ELIZABETH, N. J.

WRITE FOR COMPLETE DETAILS AND NEAREST DISTRIBUTOR

For More Information Circle No. 65 on Reader Service Card.

NEW PRODUCTS *continued*

Gas-Air Blow Pipe

A blowpipe designed to burn city or natural gas, propane or butane, in combination with compressed air, for large area soldering operations (like automotive work) has been introduced by the Harris Calorific Co. Torch features leak-free brass body, has instant relighting with pilot light and lever handle action, and long life stainless steel burner head. Head of the Harris No. 89.2 has a wide range of flame adjustments.

Circle No. 86 on Reader Service Card.

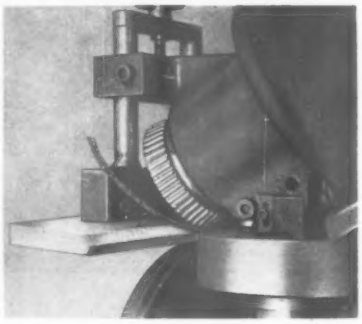


Plate Bevelling Machine

A new bevelling machine introduced by American Pullmax Co., can reduce plate preparation time for welding operations. The machine grips the steel plate between the lower supporting roller and a serrated upper cutter. As the machine self-feeds the plate it cuts a bevel up to maximum width of ½-inch. Overall production and time as contrasted to grinding or burning is said to be reduced about 85%.

The machine, which uses a 2hp motor, can handle ⅜" thick stainless steel and can cut mild steel at speeds of 11fpm.

Circle No. 87 on Reader Service Card.

Welding-Cutting Outfit

A complete welding and cutting outfit, packaged as a single unit and capable of handling a full

range of shop work, including welding, cutting, heating, brazing and soldering, has been introduced by Victor Equipment Co.

The manufacturer reports this Super-Range outfit is assembled from standard apparatus and includes: two single-stage regulators, welding torch, cutting attachment, three welding torch nozzles and a cutting tip, 12½-feet of $\frac{3}{16}$-inch diameter dual welding hose and spark lighter, goggles and wrench.

As packaged, the Super-Range unit can weld metal ¼-inch thick and cut up to 1-inch. By adding other nozzles and tips, working range can be increased. Price is $99.00.

Circle No. 73 on Reader Service Card.

New Bender Attachments

Two new attachments, dies for bending handrail capping into lambs' tongues, (shown) volutes and edgebends and single turn dies (two sizes) for forming single and double turn scrolls, have been announced by Hossfeld Manufacturing Co. for use with their Universal Pipe, Bar and Angle Iron Bender.

Circle No. 88 on Reader Service Card.

Hard Surfacing Electrode

A new low-hydrogen nickel-manganese AC-DC electrode has been announced by All-State Welding Alloys Co., Inc. It is recommended for joining and wear-surfacing austenitic manganese and carbon steels in place of currently used, and more expensive stainless steel electrodes.

Circle No. 89 on Reader Service Card.

Industrial X-Ray Film

The Gevaert Company of America, Inc., has introduced a new X-ray film. Named Structurix D-2, this film has high radiographic sensitivity and finest grain for maximum detail. At present this film has no counterpart on the market.

Structurix D-2 is a special item designed for recheck and laboratory research work. It is made for inspection of thin or medium-thick sections of light metal at low and medium kilovoltages.

Circle No. 90 on Reader Service Card.

more new products on next page

For More Information Circle No. 60 on Reader Service Card.

S-M-S

Adjust-A-Angle Adapters with Adjust-A-Pressure Holders solve many welding problems

Change from one electrode spacing to another in a matter of minutes—with the same set-up.

FREE: Write for descriptive data on complete line of resistance welding products.

Another step to better welding.

S-M-S Corporation

8605 Livernois Avenue

Detroit 4, Michigan

Miss Liberty says:

"CONFIDENTIALLY I PREFER A Dockson TORCH"

Dockson Welding and cutting torches are lighter, better balanced, built to last with rigid, silver soldered one piece construction. Designed to do the job better, faster.

Service parts available from stock.

Check the complete Dockson line of Better Built Welding Equipment. Write for catalog 56-05.

Dockson CORPORATION

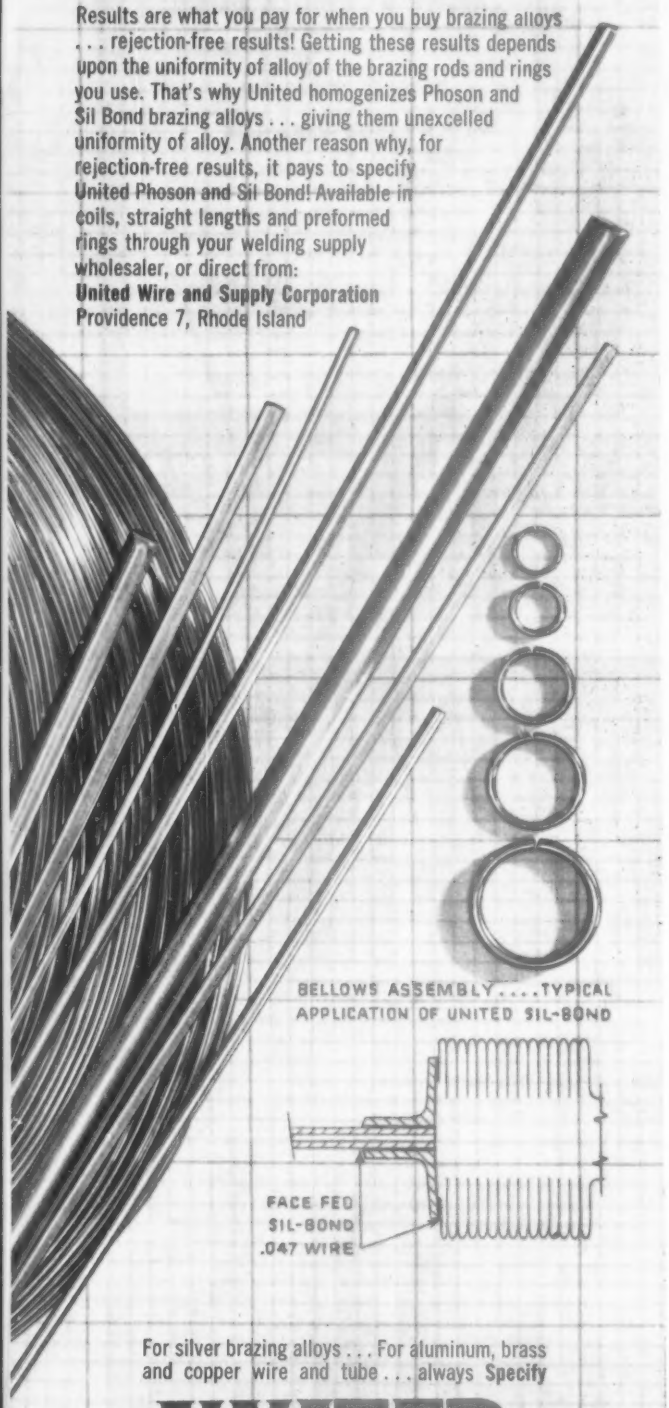
3839 Wabash Ave., Detroit 8, Mich.

For More Information Circle No. 24 on Reader Service Card.

UNIFORMITY

Reason why—it Pays to Specify
Phoson and **Sil Bond** Brazing Alloys

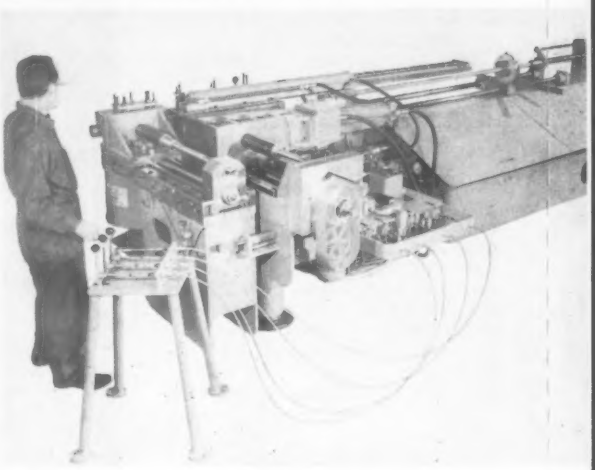
Results are what you pay for when you buy brazing alloys . . . rejection-free results! Getting these results depends upon the uniformity of alloy of the brazing rods and rings you use. That's why United homogenizes Phoson and Sil Bond brazing alloys . . . giving them unexcelled uniformity of alloy. Another reason why, for rejection-free results, it pays to specify United Phoson and Sil Bond! Available in coils, straight lengths and preformed rings through your welding supply wholesaler, or direct from:
United Wire and Supply Corporation
Providence 7, Rhode Island



For silver brazing alloys . . . For aluminum, brass and copper wire and tube . . . always **Specify**

Permanently United

UNITED



Tube Bender for Stainless and Aluminum

The latest precision tube bender in Wallace Supplies Manufacturing Company's "Consensus" line is for bending thin walled stainless and aluminum tubing. It will bend to a maximum of 180° in stainless tube to 5-inch O.D. by .085-inch wall or in aluminum tube to 6-inch O.D. by .065-inch wall, depending on alloy and yield point. RPM of bending arm is approximately 2½ maximum. Mandrel clearance of 12½-feet is standard but may be extended to order. Radius adjustment is 28-inches maximum

Measuring devices are not needed to set-up the machine. Micrometer positioning dials for the pressure die, clamping die and shoe are built into it. Degree of bend is selected from the degree dial. Length gauges are set from a length scale mounted on the machine. A protractor is built into it for rotation of planes between bends. There is an eight station degree-of-bend selector for a series of bends on a single length of tubing. By having the bends needed on a length of tubing placed on a process card, any inexperienced operator can set up and duplicate exactly the original bends made.

For More Information Circle No. 91 on Reader Service Card.

Chemical Removal of Scale and Oxide

The development of a new chemical process for the removal of welding scale and oxidation from stainless steels has been announced by Chemclean Products Corp. It is said this new process can be used in any welding situation to eliminate present welding scale- and oxidation-removal methods, such as grinding, sanding and compounding, and cut manufacturing and labor costs.

For More Information Circle No. 22 on Reader Service Card.

Radiographic Field Unit

A portable isotope machine made by Picker X-ray Corporation packs up into a case no larger than an overnight bag. The unit can be operated with either of two radiation sources: Iridium 192 or Thulium 170. When loaded with Iridium 192 source of 10 curies, it radiates energy equivalent to that of a 600,000 volt x-ray machine. With Thulium 170 source (50 curies) it radiates energy equivalent to that of a 125,000 volt x-ray machine. With Iridium 192, the unit carried on-the-job can radiograph steel piping, storage tanks, aircraft landing gears, or any steel fabrication from ⅜" to 2" thick.

For More Information Circle No. 92 on Reader Service Card.

←For More Information Circle No. 71 on Reader Service Card.

Save-A-Life Kit

The Savalife kit developed by Gas Arc Supply Co. is an emergency cutting outfit as well as a first-aid inhalator. It includes a heavy-duty cutting torch and an inhalator that delivers up to 6 liters of pure oxygen.

The unit is housed in an aluminum case 26-inches high, 15-inches wide and 7-inches deep. The case is equipped with criss-cross web strapping for carrying on the back.

Circle No. 93 on Reader Service Card.

Burn-Out Protection For Engine-Driven Welders

"Saf-T-Thaw" is the name of a protective device developed by Hobart Bros. to prevent gasoline engine-driven arc welders from burning out when overloaded for a long period of time, as when thawing frozen water pipes with welders rated at less than 400 amperes. The device is connected in the welder circuit: at the source or any remote point in it.

Circle No. 94 on Reader Service Card.

New Brazing Kit

The Kwik-Kit is the name of a complete hard and soft soldering outfit for plant and maintenance personnel. The new kit is announced by Special Chemicals Corp.

Designed for the maintenance man and service industries, the kit offers all materials for emergency repairs and upkeep jobs. All metals except aluminum, magnesium and titanium may be joined with soft solder and silver brazing alloy in the unit. Fluxes for both come in a hand size, unbreakable squeeze bottle, packaged in a neat, rigid transparent, covered plastic box.

Circle No. 95 on Reader Service Card.

Grinding Wheel Dresser

A wheel dresser that runs on a resilient bushing and shapes and sharpens grinding wheels from ¼- to 20 inches in diameter with little pressure has been announced by Thompson Sales. The Thompson No. 514 dresser features instant changing of worn cutters; they are a combined unit, not in loose-blade form.

Circle No. 96 on Reader Service Card.

Circle No. 23 on Reader Service Card.

Get the exact current for quality welding!

USE THE TONG-TEST AC-DC AMMETER

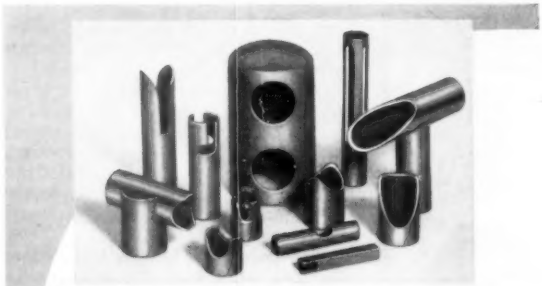
Don't assume your welders are using the right amperage. *Be certain* by controlling welding quality with the Columbia Tong Test AC-DC Ammeter, the only clamp-type instrument that measures both alternating and direct current. Snap tongs around the electrode cable for instant readings. Available in five types with interchangeable ranges up to 1000 amperes. Impossible to read wrong scale. No coils or wires to burn out—no electrical connections needed.

COLUMBIA

Write for illustrated 8-page Catalog IW-400

Columbia Electric Mfg. Co.

4545 Hamilton Avenue • Cleveland 14, Ohio



Look — at these sheared tubular ends — clean, true contoured and close fitting with a minimum of burr and distortion . . . ***You can make them fast,*** some up to

2000 an hour with Vogel patented tools. Or, if you prefer, we can do your notching, shaping, shearing and perforating . . . Either way

You save on cost!

ARC-FIT® notches up to 720 per hour.

ARC-SNUG prepares pipe ends for snug brazing—up to 500 pieces per hour.

ARC-TWIN® double notches pipe up to 750 pieces per hour.

CUT-OFF shears tubing in two up to 2000 per hour.

Samples of shearing and notching (also estimates) gladly furnished without obligation.

VOGEL TOOL & DIE CORPORATION

1819 N. 32nd Ave., Melrose Park, Ill.

For More Information Circle No. 74 on Reader Service Card.

FOR

HARD SURFACING

USE HARD-N-TUFF

The STEEL HARDENING COMPOUND that makes TOOLS and PARTS LAST 300% LONGER!

Used by leading firms for hard-surfacing of gears, taps, dies, and other tools and parts subject to wear.

- Works on any kind of steel, cast iron, or iron-base powdered metals. Makes mild steel outwear tool steel.
- No special equipment needed. Treat tools in your own shop in only 5 to 10 minutes.
- Nitrides, carburizes and chromizes in one simple operation.
- Produces file-hard case with tough inner core.
- Creates no distortion or change in dimensions.
- Safe! Contains no caustic ingredients.

CASE HISTORY

Chisel made from ordinary 1020-1/2" drillrod, hardened with HARD-N-TUFF, cut rust-locked nut with 2 hammer blows. Cutting edge was completely undamaged.

Write for FACT SHEET

showing how easy it is to use HARD-N-TUFF to cut costs and increase production.

HARD-N-TUFF CORPORATION

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Through research ... a better way
A.O.Smith
CORPORATION
WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin

Flood FIBER GLASS WELDING HELMETS
For Safety, Comfort and Economy

These seamless fiber glass units (of thermo-setting, polyester resin) are compression-molded and stoutly reinforced to afford maximum protection. All are fitted with a new ratchet type head gear which adjusts to size with the flick of the fingers. Headgear material (of high impact plastic) is smooth, easy to clean and unaffected by chemical reaction.

No. 51-8F-P14

NEW DESIGN ADVANTAGES
1. Lighter weight for more comfort.
2. A smoother and stronger shell.
3. Easier cleaning and sterilizing.
4. Non-warping moisture-proof construction.
5. Superior resistance to heat.

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Enjoy real savings with Flood's
1000-HOUR COVER LENS
Outlasts 125 glass lenses. Reduces eye fatigue. Safer because shatter-proof.

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3037 WEST LAKE STREET, CHICAGO 12, ILLINOIS

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New Nibbler Attachment

A new nibbler attachment made by Fenway Machine Co. makes possible easy cutting of perfect circles.

The new attachment with a nibbler is designed for prototype work in development labs, maintenance departments, and metal shop fabrication.

The 13 lb. HN nibbler has cutting limits for stainless up to 10 ga. (.140). The MN model for lighter metals has capacities up to 14 ga. (.078).

The HN nibbler is said to cut a 15" circle (11 ga. stainless) in 4½ minutes, overall time includes make ready.

Circle No. 97 on Reader Service Card.

High Tensile Electrode

A new, all-position electrode for welding high tensile steels has been developed by Eutectic Welding Alloys Corp. EutecTrode Super 110 (AC-DC) provides tensile strengths of over 110,000 psi.

The electrode is said to be ideal for all types of structural welding, with no restrictions placed on joint design, size or position of welding. Welds have exceptional ductility and elongation, which virtually eliminates any tendency toward bead cracking.

The new alloy is said to be ideal for T-1 steel and similar copper-containing grades. It is available in $\frac{3}{32}$-, $\frac{1}{8}$-, $\frac{5}{32}$- and $\frac{3}{16}$-inch diameters.

Circle No. 98 on Reader Service Card.

Plastic-Body Stock Valve

A new plastic-body stock valve has been developed by W. G. Rovang & Associates, Inc., for use with some of the corrosives used in the paper, chemical processing and petroleum industries. The valve is said to be more corrosive resistant than stainless steel and costs less than stainless and substantially less than alloys with comparative corrosion-resistant characteristics. The plastic body is glass-reinforced with high impact polyester resin; it is vibration-proof, re-

sists acids and alkalis and withstands pressures of 150 psi at temperatures up to 300°F.

The new valve is bonnetless and comes in sizes from 3- to 12-inches. Improved design provides nonplugging, smooth flow; it is equipped with a new drip-tight rubber seat that assures complete shut-off.

Available with alloy or PVC plastic blade, the plastic valve also comes equipped for manual or remote control operation. The Rovalve valve illustrated has a cylinder for air or hydraulic operation; a motor mount or hand wheel is also available.

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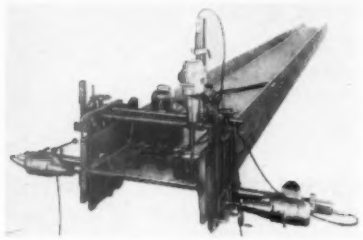

Portable Spacing Drill

Shlagro Steel Products Corp. has announced the development of a new spacing drill for structural steel and plate fabrication.

The drill consists of a unique carriage with flanged wheels, adaptable in width and height and made to run along flanges of the beam or girder. The frame has positive locking devices for accurate positioning. Three drills are carried by the frame. The drills are arranged about the beam so that a drill faces each of the flanges, with the third drill facing the web.

Pressure of 2000 lbs. is applied to the drills by a power- hydraulic pump. The drills move transversely across the web and flanges easily and smoothly. Measuring scales are built into the unit. Drilling of holes requires no marking and center punching.

Circle No. 100 on Reader Service Card.

Portable Machine Welds Studs to Aluminum

A new portable welder developed by Graham Mfg. Corp. welds insulation pins or studs up to ¼-inch diameter to light gauge aluminum as well as other metals without distortion or discoloration. Graham's patented welding process as incorporated in the new Super-Six portable machine welds low-cost studs to aluminum or steel without the use of inert gas, flux, ceramic ferrules, or compressed air connections and operates from any standard 110 volts, AC electric outlet.

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CUT Cleaning Costs with

NO-SPAT

WELDING FLUID

Fixtures, weldments and surrounding surfaces are kept free of spatter. Costly chipping and grinding is eliminated. NO-SPAT is non toxic, and also suppresses fumes generated by welding! NO-SPAT prevents rust and it conditions metal surfaces for painting! Some users coat entire metal equipment with NO-SPAT for maximum ease of welding, rust prevention, and paint conditioning. Shipped ready to use.

Write today for your free test sample.

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Save up to 60% on every grinding job!

GASTON POWER TOOLS

EXTRA POWER! EXTRA FEATURES! EXTRA PERFORMANCE!

NO BRUSHES! NO COMMUTATOR! NO ROTOR WINDING!

SPECIAL . . . FREE THREE DAY TRIAL ON ANY GASTON POWER TOOL—Disc Grinders, Edge Grinders, Direct Drive Edge Grinders, Right Angle Grinders and Aluminum or Stainless Steel Polishers . . . All in your voltage requirement. (3-phase, 60 Cycle)

A completely sealed motor—This and our many other exclusive features practically eliminate "down-time" due to service difficulties.

It's true . . . for faster, more economical production grinding or polishing . . . comparative tests prove conclusively that Gaston Grinders and Polishers do the job quicker—up to 60% faster than many others.

Initial cost, operation and maintenance run more than 50% below costs of comparable tools of the same horsepower rating.

Sales representatives in all markets to assist you in selecting the proper tool for your particular needs.

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Write for free literature describing the entire line of Gaston Power Tools.

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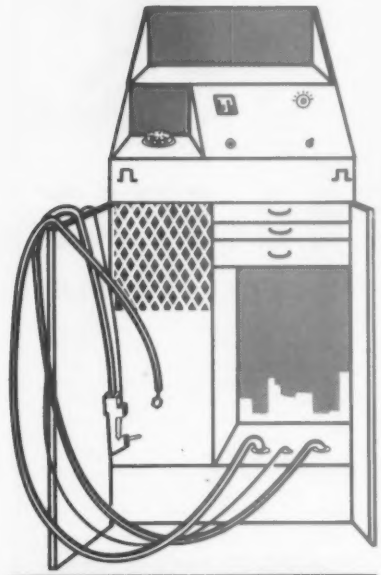

IT MEETS THE CHALLENGE!

PIONEER INDUSTRIES' POKE WELDER (Model 302) . . . THE MOST VERSATILE IN THE INDUSTRY. AND IT'S *MOBILE*, TOO!

FROM DELICATE TACKING OF THE THINNEST CORE OF FOIL TO STAINLESS STEEL . . . ALL THE WAY TO HEAVIER SKIN STRUCTURES!

THIS MODEL 302 with 20 KVA Power Pack can solve your problems with its wide range of plant use. Just one more example of Pioneer Imagineering for modern industry!

For complete information and literature, write

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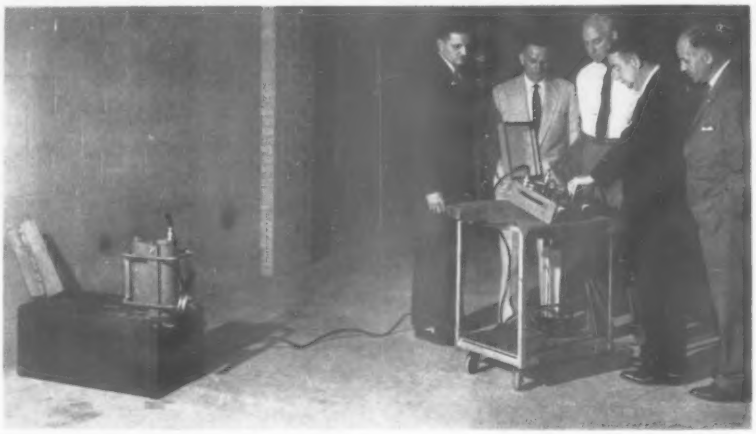
WELDING MANAGEMENT

• *watches these developments*



BECAUSE A WELDING SUPPLY DISTRIBUTOR needs well-trained salesmen with a great deal of technical knowledge to sell X-ray equipment, A. C. (Andy) Axtell, president of Essex Welding Supply Co., Newark, N.J., sent four of his salesmen to a special X-ray training school in Baltimore when his firm took on Westinghouse Electric Corporation's X-ray equipment line. Going over a typical inspection set-up are (left to right) Charles Schilling; Frank Portik; John Chamberlin, vice president and sales manager; Kenneth Brown and Andy Axtell who feels that specialty distributors should handle such equipment to round out their lines.

"THE TREND IN THE WELDING INDUSTRY is towards the use of versatile, semi-automatic welding equipment that can be readily adapted to model changes of a product," says John J. Chyle, director of research, A. O. Smith Corp. "This is because there are not too many applications where it will pay to spend $100,000 or more for a one-purpose fully automatic machine.

"In many cases fully automatic equipment has definite limits because of the shape and size of the article. It is not versatile to a wide range of parts. The big trend is towards the replacement of manual welding with the highly versatile semi-automatic welding.

"For high production of welded products where the production rate may be in the range of 100,000 to a million parts, fully automatic, push-button welding can show marked savings and is therefore justified."

A FULL SCALE TEST OF WELDED CONSTRUCTION took place recently in Toronto, Ontario, when the 11-story welded steel framework of a new building collapsed in a high wind and was completely demolished. Two consulting firms reported that the steel framework, which had been welded up to the seventh floor, was unable to withstand extremely high local winds because of insufficient temporary bracing during erection.

A report in a Toronto newspaper stated: "The collapse proved an invaluable test of full-scale welded construction. Welding of the steel framework on the 11-story building had been completed up to and including the seventh floor level. When the building collapsed, welded sections were subjected to tremendous stresses—far greater than any they would be forced to bear under normal conditions. Ex-

perts were amazed at the way the welds took the strain. Inspection by the Canadian Welding Bureau showed that only one of several hundred had failed."

The consultants, architects and other structural engineering authorities gave unqualified approval to both the unusual design of the building, which was free of interior columns, and the welded connections.

APRIL IS NATIONAL WELDED PRODUCTS MONTH according to a presidential proclamation. This noteworthy step proclaims that our industry is no longer too modest to insist that welding should and shall be recognized publicly as a prime indispensable fabrication tool in industrial practice. Each year "National Welded Products Month" will be declared to coincide with the annual American Welding Society convention.

Publicity plans set up by the A.W.S. Publicity Committee include use of the emblem at left (and similar ones) and the phrase "April is National Welded Products Month" on advertisements and on letters and postal meter tapes. Suitable plaques will be displayed in exhibit booth at the AWS meeting in April. Cloth banners with this seal will be displayed in the convention hall.

Eighty-one AWS sections throughout the country have been alerted. Local plans include: proclamations by governors and mayors, cooperation by local industries, plant tours, department store promotions and civic functions.

THIS COUNTRY'S FIRST fully automatic flame cutting machine designed primarily for shipyard use is being built by National Cylinder Gas Division of Chemetrom Corporation. The new electronically-controlled tracing and cutting machine will be completed in June. All electronic components have been proven and final design was jointly accomplished by NCG and Canadian Westinghouse Ltd. To be known as the NCG Lumotrace Cutting Machine, it will be fully automatic in operation and will utilize a "new and amazingly accurate" principle of electronic tracing (Lumatrax) developed by Canadian Westinghouse Ltd.

The machine will shape-cut steel plates at the "command" of an electronic centerline follower moving over a reduced-scale photographic image of the shapes to be cut. The image is projected on a ground-glass plate from a 4-by-5-inch photographic negative containing all template information for shape-cutting steel plates 10-by-50 feet or larger.

A PORTABLE LIQUID OXYGEN CYLINDER has now been made available for sale to manufacturers of liquid oxygen by Linde Company, Division of Union Carbide Corp. The compact LC-3 cylinder (it weighs only 493 pounds) is a double-walled, insulated container that holds a large volume of oxygen in its liquid state. Its capacity (the equivalent of 3,000 cubic feet) is more than that of 12 standard 244 cubic foot capacity cylinders weighing about 1,800 pounds full. The LC-3 meets Interstate Commerce Commission requirements and can be used for liquid argon and liquid nitrogen.

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BENDING BLOCKS
or
WELDING PLATENS
Semi-steel Blocks for layout, welding assembly work, etc., with machined working surfaces; also tools and accessories, including a full line of clamps, drift pins and dogging devices. Standard and special stands can be supplied. A 4-unit set-up, joined and mounted on stands, is shown above.
WRITE TODAY FOR LITERATURE
ACORN
IRON & SUPPLY CO.
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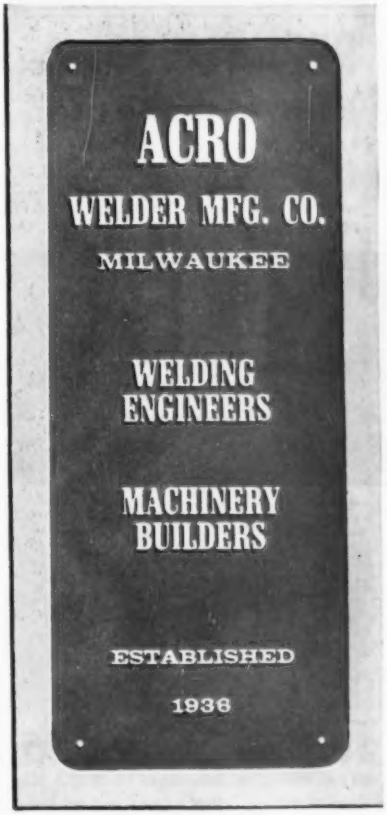

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BANTAM
IRON WORKER

THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

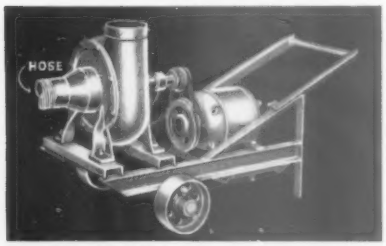
The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¼ hp motor, 1750 rpm.

Bateman Bantam with punch ... $575.00
Shear only ... $495.00
Shipping wt. 750 lbs.

BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

RUEMELIN *Portable*
Fume Collector

Removes gas, smoke and heat from welding operations. Recommended for ventilation of tank interiors, manholes, vats, airplane fuselages or for blowing fresh air into inaccessible places.



• Collector is equipped with a power unit capable of handling up to 35 ft. of steel tubing. Mounted on rubber tired wheels for ease of handling. Models also available mounted on steel legs for hose operation in a complete 360 degree circle.

• This view shows inlet hood picking up welding smoke. Operator breathing zone protected.

WRITE FOR DETAILED INFORMATION.
RUEMELIN MFG. CO.
3891 N. Palmer St., Milwaukee 12, Wis. U.S.A.
Manufacturers and Engineers • Sand Blast and Dust Collecting Equipment • Welding Fume Collectors

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REFERENCE DATA

catalogs, handbooks, manuals

CONVERTING TRASH INTO CASH is the subject of a new 4-page illustrated bulletin available from Handy & Harman. Precious metals such as gold, silver, platinum, palladium and iridium now being sold as low-value scrap or discarded as worthless can actually be worth substantial sums of cash. The bulletin describes the many forms in which wastes can be hidden in these valuable precious metals. **For More Information Circle No. 105 on Reader Service Card.**

COATED ABRASIVES information kit that makes it easier to specify and order coated abrasives is now available at The Carborundum Company. In the kit is a Buyer's Guide, Form A 1506, with convenient reference tables and forms for listing your requirements; a selector chart for metalworking operations, Form A 1507; selector chart for woodworking operations, Form A 1508; basics in coated abrasives for the metalworking trades, Form A 1509; and basics in coated abrasives for the woodworking trades, Form 1510. **For More Information Circle No. 106 on Reader Service Card.**

X-RAY FOR INDUSTRY is featured in a 12-page booklet available from Phillips Electronics, Inc. This booklet includes a complete line of x-ray equipment, description of methods and specifications, and photographs of typical industry applications. **For More Information Circle No. 107 on Reader Service Card.**

WELDING SHOP WALL CHART that lists 89 problem-solving, specialty alloys and fluxes is now available from All-State Welding Alloys Co. The Chart, 18" x 22" on heavy coated paper, sorts out the criteria in choosing an alloy for welding shop application. Maintenance, production and installation jobs are covered. Chart features each alloy's strength in the joint, its working temperature or amperage range, and special characteristics. **For More Information Circle No. 108 on Reader Service Card.**

ULTRASONIC TESTING is featured in data sheets from Branson Instruments, Inc. The data sheets illustrate and describe (1) the Vidigage, an ultrasonic non-destructive tester; (2) the Audigage, a portable ultrasonic thickness tester; (3) the Sonoray, a flaw detection tester and; (4) the Coatingage, a magnetic thickness tester. Ultrasonic metal cleaning equipment is also shown. **For More Information Circle No. 109 on Reader Service Card.**

RESISTANCE WELDING ELECTRODE HOLDERS are described and illustrated in a 20-page catalog No. 8-62 offered by P. R. Mallory & Co., Inc. The catalog lists all standard series (non-ejector or ejector) types. It also illustrates combination uses of holders, adaptors and electrodes for most resistance welding applications. **For More Information Circle No. 110 on Reader Service Card.**

INDUSTRIAL X-RAY FILMS are featured in a 32-page booklet available from Gevaert Company. The booklet gives complete engineering data and specifications on a complete line of films. It presents graphs on exposure data for different metals, and lists developing and processing accessories. **For More Information Circle No. 111 on Reader Service Card.**

TUNGSTEN CARBIDE HARD FACING is subject of Bulletin No. 139 issued by Metallizing Engineering Co., Inc. The bulletin describes and illustrates how parts are spray hard-faced with tungsten carbide. **For More Information Circle No. 112 on Reader Service Card.**

CRACK DETECTION MACHINES are featured in a 4-page brochure offered by Peterson Machine Tool, Inc. Described are a complete line of wet method magnetic inspection machines. It also provides illustration of the accessories. **For More Information Circle No. 113 on Reader Service Card.**

FACTS AT YOUR FINGERTIPS: *Do you want full information on the latest welding products shown on these pages? Just circle the appropriate number on the bound-in readers service card and you'll get it.*

REFLECTOSCOPE INFORMATION is the subject of data sheets available from Sperry Products Inc. The data sheets provide up-to-date answers on low cost ultrasonic testing. The sheets describe how the Reflectoscope locates cracks, lack of fusion, incomplete penetration, fatigue failures, even in the thickest of plate and deepest welds.
Circle No. 79 on Reader Service Card.

PRECISION TUBE BENDERS are described and illustrated in a 20-page catalog by Wallace Supplies Mfg. Co. The new catalog covers a complete line of pipe benders, including those for aircraft and missile applications.
Circle No. 114 on Reader Service Card.

PENATRAMETERS are featured in data sheet from Jem Penatrameter Mfg. Corp. The data sheet lists specifications. Key points derived from penatrameters are round accurate holes, microthickness and fast delivery on all codes.
Circle No. 42 on Reader Service Card.

FILM BADGE SERVICE available from Nuclear Advisors, Inc., is described in catalog which explains how company offers early warning protection and permanent, legal record by qualified experts at low costs.
Circle No. 57 on Reader Service Card.

INDUSTRIAL RADIOGRAPHIC and fluoroscopic equipment available from Westinghouse's X-ray Department is featured in available literature.
Circle No. 76 on Reader Service Card.

"RADIOISOTOPES IN INDUSTRY" is the title of a comprehensive folder offered by Ansco. This technical brochure gives facts and figures on the use of major isotopes and tells how the characteristics of each affect exposure time and radiographic quality.
Circle No. 11 on Reader Service Card.

LIGHT AND VERSATILE is the way Balteau Electric Corp. describes its complete line of portable X-ray equipment. Design details and operating characteristics are given in available literature.
Circle No. 16 on Reader Service Card.

MICROHM METER is the subject of a data sheet offered by J. W. Dice Co. The data sheet explains what the microhm meter can do, how it operates and lists the specifications. The meter measures surface resistance of metals prior to welding.
Circle No. 115 on Reader Service Card.

For More Information Circle No. 44 on Reader Service Card.

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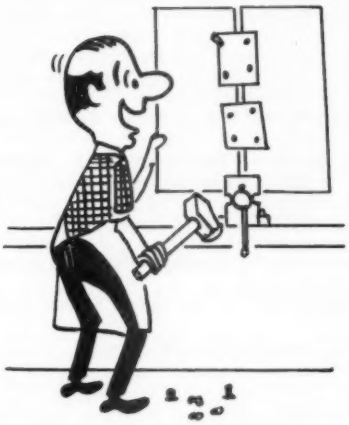
A.W.S. WELDING SHOW
APRIL 7, 8, 9 CHICAGO, ILL.

WELD IT WITH HI-AMP
ELECTRODE HOLDERS



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- Low initial cost, easy and economical to maintain.

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AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT

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GET BETTER ELECTRODE HOLDER PERFORMANCE

Clean jaws increase power flow, welding speed and reduce holder heat, eliminate arcing, pitting jaws and splitting rod coat.

ATLAS "Jaw Cleaner"

Write for Prices

1. CLEANING BROACH

Cleans corrosion, spatter and dirt off Jaws. Does not cut away metal. Double teeth clean in both directions.

2. POLISHING BRUSH

Spiral wire type with long life. Finishes the job with a like-new polish and perfect contact surface.

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USEFUL LITERATURE *continued*

GAMMA RADIOGRAPHY MACHINES made by Nuclear Systems, a division of the Budd Company, are the subject of literature available. How high quality radiographs are obtained on almost all sizes and shapes of welded vessels and components is explained.
Circle No. 13 on Reader Service Card.

CORROSION - RESISTANT PLASTIC VALVES for use in paper, petroleum and chemical processing applications are featured in Rovalve Catalog 421 issued by W. G. Rovang & Associates, Inc. Results of tests with various chemicals are described for the bonnetless valves which are available in 3- to 12-inch sizes.
Circle No. 118 on Reader Service Card.

"DUPONT PRODUCTS FOR INDUSTRIAL RADIOGRAPHY" is the title of a free booklet offered by E. I. du Pont de Nemours & Co. (Inc.) A complete line of radiographic film for all industrial applications is featured.
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IN THE SPOTLIGHT is the way literature available from Tec Torch Co., Inc. describes their new Tec Spot Gun. Literature explains how this production tool bridges the gap between resistance welding and arc welding, how the tungsten inert gas process (with either argon or helium shielding) can weld materials up to ⅛-inch thick to any metal thickness, and how the 12-ounce torch is cooled to the tip, starts with a touch.
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WELDING PLATENS are described and illustrated in a 4-page folder available from Acorn Iron and Supply Co. Folder gives physical dimensions of bending blocks or platens and stands used in conjunction with platens. It also illustrates clamping accessories.
Circle No. 120 on Reader Service Card.

PORTABLE AND LIGHT WEIGHT X-ray units and controls manufactured abroad and marketed in this country by Fedrex, U.S., are featured in literature.
Circle No. 29 on Reader Service Card.

NEW POKE WELDER introduced by Pioneer Industries, division of Almar- York Co., Inc., is featured in literature. Mobile Model 302 is designed for delicate tacking of thinnest core of foil to stainless steel . . . all the way to heavier skin structures.
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HELP

STOP ACCIDENTS • CUT TIME LOSS
REDUCE INSURANCE COSTS • SAVE LIVES!

install and use NEW
MORRISON
REVOLVING CUP GUARDS
. . . on your portable tools

HELP STOP costly accidents with MORRISON Revolving Cup Guards! Safety codes and laws REQUIRE guard protection. Specify MORRISON for maximum safety . . . lighter weight . . . lower cost . . . greater strength. Full protection for operator with minimum interference with work.

Remember, MORRISON also makes standard wheel guards. There is a MORRISON Guard for every application . . . all are made to comply with American Standard Safety Code.

See your grinding wheel supplier or write:

MORRISON PRODUCTS INC. 16816 Waterloo Road, Cleveland 10, Ohio

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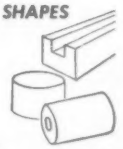
● ***WELDING ELECTRODES, WELDER BRUSHES*** . . .
Keen-Arc Carbons, cored and heavily copper coated, for twin-arc torches, carbon and graphite welding electrodes . . . paste, rods and plates.

● ***EXTRUSIONS, MOLDED SHAPES OR SPECIAL CARBONS***
designed and produced to your specifications.



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Circle No. 18 on Reader Service Card.

NEW PUFF CAMERA for industrial radiography is described in literature available from Curtiss-Wright Corporation. Illustrated literature outlines features, applications, construction and operation. It also gives an operating diagram with specifications for four different models.
Circle No. 124 on Reader Service Card.

BRONZE WELDING ELECTRODES are the subject of a fourth quarter bulletin available from Amco Metal, Inc. The bulletin features information regarding the overlaying of steel pipe expander rings with Amco-Trode 250 electrode. The bulletin also describes the repairing of a 3000-pound board drop hammer ram and other interesting applications.
Circle No. 125 on Reader Service Card.

PROTECTED "C" CLAMP is described and illustrated in a 3 page folder available from Havens Steel Co. The folder gives engineering specifications on standard throat and deep throat clamp. Screw threads are protected by a sleeve. Clamp is said to really hold and not walk.
Circle No. 126 on Reader Service Card.

HANDI ARC is the name of a new portable welding gun introduced by Frank Niemi Metal Products, Inc. Literature available from the company describes and illustrates the tool and gives complete operating instructions.
Circle No. 55 on Reader Service Card.

GAS REGULATORS AND ACCESSORIES made by Air Reduction Sales Co. are featured in a new 36-page catalog. It covers their complete line of cylinder, manifold and station pressure regulators. The illustrated booklet contains flow and pressure specifications, as well as inlet and outlet connection dimensions. Also described are adapters, station valves, flowmeters, hose connections and pressure gauges.
Circle No. 129 on Reader Service Card.

NEW HIGH TENSILE ELECTRODES are featured in a data sheet offered by Lincoln Electric Co. The data sheet describes Jetweld LH-90 and LH-110. It gives procedures and physical properties of each, and their outstanding characteristics.
Circe No. 130 on Reader Service Card.

GRINDING WHEELS AND ABRASIVES are the subject of a new catalog from the Thermacote Co. The catalog lists many new abrasive products and gives price information on them.
Circle No. 131 on Reader Service Card.

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Just You TRY to *Break a*

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A SELF-CONTAINED WELDER that would conceivably utilize the energy produced by nuclear fusion is one of a number of futuristic welding units that will be exhibited by the Welding Products Division of A. O. Smith Corporation during the American Welding Society Convention in Chicago, April 6-10.

Expect Record 15,000 at Annual Welding Show

CHICAGO, ILL.: A possible record attendance of 15,000 is predicted for the AWS 7th Annual Welding Show to be held here from April 7 through 9. Previous high was set at the Philadelphia exhibit in 1957 when approximately 11,000 persons toured the welding displays.

Running concurrently with the Welding Show is the Society's Annual Convention at which 21 technical sessions, comprising 63 papers, will be presented.

The International Amphitheatre is the site for the Welding Show; convention activities will center around the Hotel Sherman.

Rovang Expands Fabricating Services

Expanded facilities for fabricating acid- and alkali-resistant materials are now available in the Pacific Northwest at the Portland, Oregon, plant of W. G. Rovang & Associates, Inc. Specialists in fabricating stainless steels, alloys and plastics, the company makes equipment for processing and moving corrosive gases, liquids and slurries.

Weldments available included stainless pressure vessels, such as digesters, tanks and other processing units. Also fabricated are manifolds, condensers and heat exchangers. These are designed and built to meet ASME Code requirements.

The company makes one- to 6-inch pipe and tube on a continuous automatic mill. Larger sizes are fabricated and welded by the automatic inert gas process from sheet up to ½-inch thick.

Krieg Expands in Newark

NEWARK, N.J.: Charles W. Krieg Company has moved to new, larger quarters at Central Avenue and 2nd Street. Welding equipment sales and service facilities will be established in a 36,000 square foot building with three loading bays.

Started in 1914 as a small, three-employee sales outlet for Lee Tire & Rubber Company, the firm was acquired by Krieg in 1924. Since that time the company has taken on a complete line of welding equipment and supplies. It now employs 50 employees.

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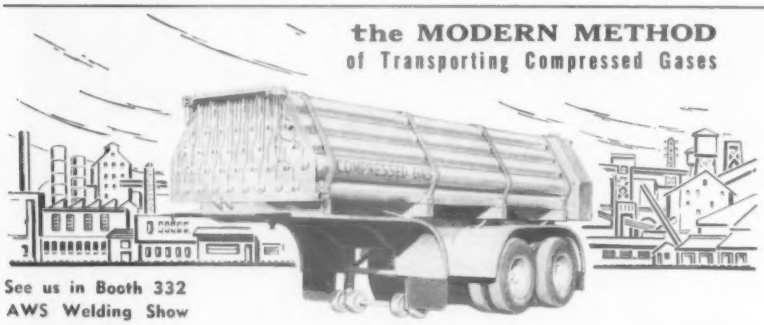

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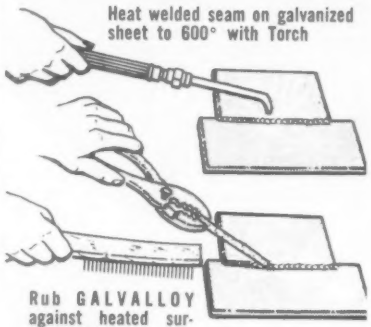
Heat welded seam on galvanized sheet to 600° with Torch



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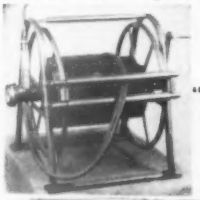
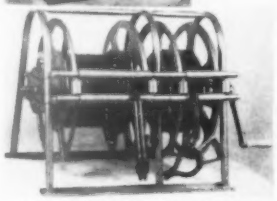
Welders' Heavy Duty Reels
For Truck or Shop Installation



The "PIPE-LINER" saves hose



The "TWIN-REEL" saves cable

The "PIPE-LINER" 250 ft. ¼-inch twin welding hose reel capacity, features a rotating gas connection, full width guide rollers, outboard bearing and reel crank, $49.50 FOB Salem, Va. Model EW-2 electric cable "TWIN-REEL" has a capacity of 250 ft. electrode and 125 ft. ground 1/0 cable. Model EW-2 has permanent terminal connections, guide rollers and crank with reel selector—$125.00 FOB Salem.

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WANTED
ASSISTANT PRODUCTION SUPT.

Preferably a graduate mechanical or welding engineer with 5-10 years welding fabrication shop experience in miscellaneous heavy steel, aluminum and stainless steel weldments. Experience in modern techniques and applications desired. Ability to organize and operate efficient shop very important. A large growing company offering an excellent future. Located in the middle west. Write Box 2159, INDUSTRY & WELDING Magazine, 812 Huron Road, Cleveland 15, Ohio.

Western Metal Expo Features New Products

LOS ANGELES, CALIFORNIA: A showcase of new development for immediate application by the west's metals industries is the description given the forthcoming 11th Western Metal Exposition. More than 350 exhibiting firms will reveal industrial and metals progress.

Dates for this educational display in Los Angeles' Pan-Pacific Auditorium and combined pavilions will be March 16-20.

At the same time the 11th Western Metal Congress will hold technical sessions in Los Angeles' Ambassador Hotel.

Distributor Appointments

Harnischfeger Corporation, Milwaukee, Wisconsin: A-D Machinery Co., Inc., Elko and Las Vegas, Nevada; Brammer Welding Supply Co., Lynchburg, Va.; Grand Rapids Welding Gas & Supply Co., Grand Rapids, Mich., and Welder Supply Co., Inc., Richmond, Va.

Ampco Metal, Inc., Milwaukee, Wisconsin: American Oxygen Service Corp., Harrison, N.J. (Ampco Bronze Weldrod products), and Lewis Industrial Supply Co., Louisville, Ky. (resistance welding products).

Welding Engineer

The Armour Research Foundation has an opening for an experienced welding engineer. Applicants should have several years of experience in welding and brazing research with at least a B.S. degree in Welding or Metallurgy.

The Foundation is located on the campus of the Illinois Institute of Technology and encourages graduate engineering study through its education program providing tuition free graduate study, in addition to offering competitive salaries and liberal benefits including generous relocation allowance and vacation program.

Please send complete resume to:

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Acorn Iron & Supply 75
Acro Welder Mfg. Co. 75
Air Reduction Sales Co. 5
Alloy Rods Co. 26
All State Welding Alloys Co., Inc. 65
Allison-Campbell Division, American Chain & Cable Co. ... 17
Alphil Spot Welder Mfg. Corp. .. 63
American Brass Company .... Inside Back Cover
American Chain & Cable Co., Allison-Campbell Division 17
American Optical Company 18
American Platinum and Silver Division, Engelhard Industries, Inc. 16
Ansco 49
Arcos Corporation 20, 21
Armour Research Foundation of Illinois Institute of Technology 81
Aronson Machine Co. 2
Atlas Welding Accessories, Inc. .. 78
Balteau Electric Corporation 54
Bateman Foundry & Machine Co. . 76
Becker Brothers Carbon Co. 78
Bernard Machine Mfg. Co. 81
Cam-Lok Division, Empire Products Inc. 8
Chemclean Products Corp. 68
Columbia Electric Mfg. Co. 71
Dockson Corporation 69
E. I. du Pont deNemours & Co. Inc. 45
Duro Engineering 9
Engelhard Industries, American Platinum and Silver Div. 16
Eutectic Welding Alloys Corp. ... 39
Evans Rule Company 82
Fedrex, U. S. 56
Fibre-Metal Products Co. 4
Flood Safety Products Co. 72
Flinn & Dreffein Engrg. Co. 73
Hard-N-Tuff Corporation 71
Harnischfeger Corporation 23
Harris Calorific Company 61
Hobart Bros. Company 1
Independent Engineering Co. 80
International Nickel Co., Inc. 22
Jackson Products Inside Front Cover
Jem Penetrameter Mfg. Corp. 57
Kasenit Company 81
Lenco, Inc. 77
Lincoln Electric Co. 15, 33
Metalloy Products Co. 80
Midland Paint & Varnish Co. 73
Miller Electric Mfg. Co. 11
Morrison Products Co. 78
Milwaukee Electric Tool Corp. ... 12
National Carbide Company 77
National Welding Equipment Co. . 24
Nickelson Tool & Die Corp. 81
Frank Niemi Metal Products Inc. . 67
Norton Company 25
Nuclear Advisors, Inc. 57
Nuclear Systems, a Division of the Budd Company 50
Pioneer Industries, division of Almar-York, Inc. 74
Ruemelin Mfg. Company 76
S-M-S Corporation 69
Shawinigan Products Corp. 57
Simonds Abrasive Co. 13
A. O. Smith Corp. 72
Sperry Products, Inc. 53
Stoody Company 34
Stulz-Sickles Co. 68
Superior Welding Co. 64
Tempil Corporation 62
Thermacote Company 79
Tipaloy, Inc. 30
Tuffaloy Department of Air Reduction Sales Co. 65
United Wire & Supply Corp. 70
Vee-arc Corporation 79
Victor Equipment Co. 10
Vogel Tool & Die Corp. 71
Watchemoket Optical Co. 63
Wolverine Tool Company 64
Westinghouse Electric Corp., X-Ray Division 40

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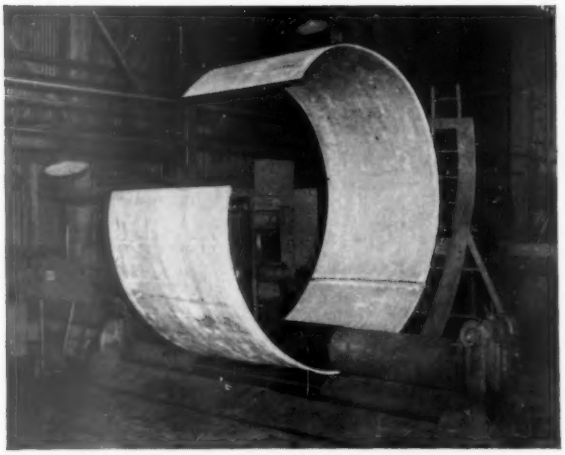
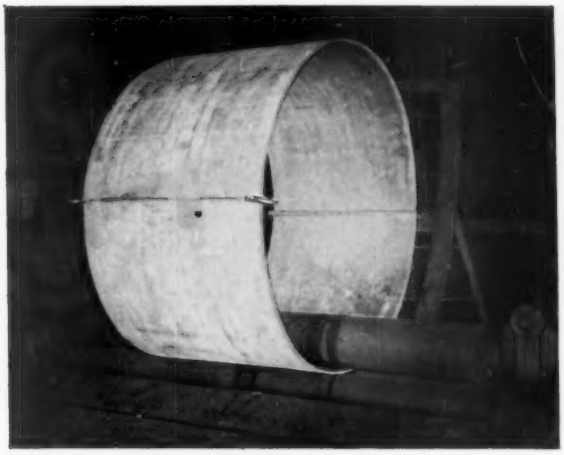
Get the lion's share of meaty facts out of this issue of INDUSTRY & WELDING MAGAZINE before you pass it along to the next reader. Leaf through once more: If you want full details on any item, the Reader Service Card will bring them to you quickly. No postage needed.

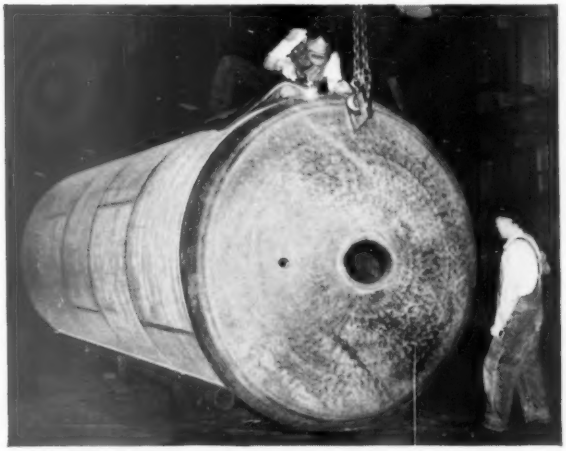
Tanks, heat exchangers and processing equipment for tough jobs are fabricated quickly and easily of corrosion-resistant Everdur®



At Old Dominion Iron and Steel Corporation, Belle Isle, Richmond, Virginia, *(O.D.I.S.), fabricators of tanks, heat exchange equipment and pressure vessels,* two plates of Everdur-1010 (151″ x 56$\frac{3}{16}$″ x .513″), previously welded together, are rolled to form a cylindrical tank section.



When rolling is completed the beveled edges of the plates are butted to form a vee groove which then will be welded to complete the section. Five such sections will be put together by *Old Dominion Iron & Steel Corporation* to make the 26′-9″ shell of the storage heater.



The storage heater is completed by attachment of two flanged and dished heads 96″ outside diameter. The heads were press-formed and spun by *Old Dominion Iron and Steel Corporation* from circles of Everdur-1010, 104″ in diameter and .674″ thick.

The completed 10,000-gallon storage heater has 198 feet of welds. All welding was done with the inert-gas tungsten-arc using Everdur-1010 Welding Rod, which makes welds that meet ASME Boiler and Pressure Vessel Code requirements for soundness, strength, ductility.

EVERDUR-1010 provides the high strength and excellent corrosion resistance needed for all kinds of hot-water storage tanks and for pressure vessels and equipment used in the chemical and processing industries. This tank will be used for hot-water storage in a wool-dyeing plant.

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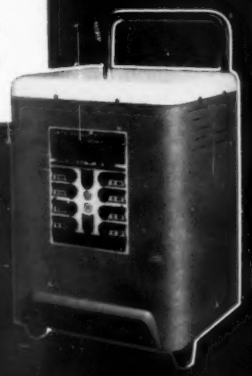

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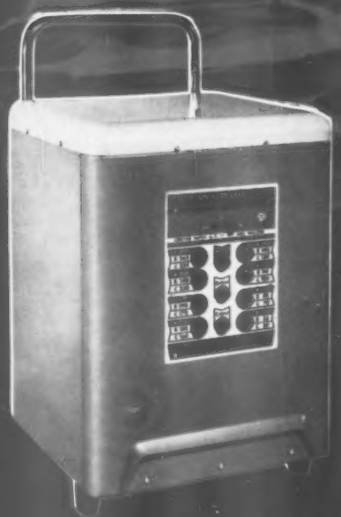

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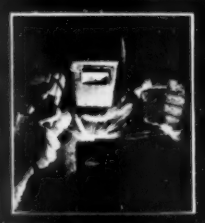

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